

STAFF REPORT 08-14-2019 REGULAR MEETING
APPLICATION NUMBER: 19-6369
VIOLATION NUMBER: 19-308
ADDRESS: 220 W CONGRESS STREET
HISTORIC DISTRICT: DETROIT FINANCIAL DISTRICT
APPLICANT: DORIAN MOORE
STAFF SITE VISIT: 08-02-2019

PREPARED BY: A. PHILLIPS

PROPOSAL

The building located at 220 W Congress Street is a 5-story commercial structure originally constructed as a glove factory in the early 1900s. According to the Sanborn Maps, the building is constructed with steel columns and enclosed with brick and block. There have been multiple interior and exterior renovations to the building. As it exists today, the south façade (front) of the building is clad in metal panels with dark-tinted fixed ribbon windows. At the east and west edges of the façade exists a painted panelized cladding system with a stucco-like finish. This finish wraps the corner of the building and extends on a little less than half of the west façade (alley side). The remaining portion of the west façade, the north façade (rear), and the rear portion of the east facade is comprised of painted brick. The front portion of the east façade abuts the adjacent building and is not visible. As it currently exists, the first floor store front is pushed beneath the façade of the upper floors. The structural columns continuing from the upper floors down to grade creating a covered entrance at the street level. The existing alley located directly to the west of the building is sloped to mitigate the grade change between Congress Street and the rear alley.



With the current proposal, the applicant is seeking the Commission's approval **to perform a general rehabilitation of the building per the attached drawings**. Included in the proposal are the following exterior scope items:

- **South Façade (Congress Street)**
 - Replace all existing windows with new fixed aluminum windows, storefront, and doors with frames in the color of "Champagne Gold"
 - Modify existing first floor storefront footprint
 - Repair existing metal panel cladding as needed above first floor storefront
 - Replace existing metal panel cladding at first floor exterior columns
 - Paint existing metal panel cladding (Color: Sherwin Williams SW 9171 "Felton Wool")
 - Paint existing stucco-like material at east and west ends of façade (Color: Sherwin Williams SW 7020 "Black Fox")
 - Install new coping at top of parapet (Color to match storefront/windows)
- **West Façade (Side Alley)**
 - Replace all existing windows with new fixed aluminum windows with frames in the color of "Dark Bronze"
 - Add (3) new masonry openings at first floor for storefront (Size varies)
 - Add (2) new masonry openings at first floor for person doors (Size: 3'- 4" W x ~12' H)
 - Add (1) new masonry opening (Size: 6" x 6") at second floor for air intake
 - Remove existing exhaust hood at the second floor
 - Repoint existing masonry in multiple locations
 - Repair existing stucco-like material at front half of elevation
 - Paint existing stucco-like material at front half of elevation (Color: Sherwin Williams SW 7020 "Black Fox")
 - Power wash existing painted brick at the rear half of elevation and leave unpainted
 - Add (1) new exterior pre-fabricated metal stair at rear of elevation, allowing access to higher elevation of rear alley
 - Add (7) new exterior lights (specification unknown) along elevation at ~16' above grade
- **North Façade (Rear Alley)**
 - Replace all existing windows with new fixed aluminum windows with frames in the color of "Dark Bronze"
 - Add (1) new masonry opening (Size: 6" x 6") at third floor for air intake
 - Repoint existing masonry in multiple locations
 - Paint existing brick (Color: Sherwin Williams SW 6334 "Flower Pot")
- **East Façade (Adjacent to existing building – Rear portion of façade is visible)**
 - Replace all existing windows with new fixed aluminum windows with frames in the color of "Dark Bronze"
 - Repoint existing masonry in multiple locations
 - Paint existing brick (Color: Sherwin Williams SW 6334 "Flower Pot")
- **Roof**
 - Replace existing roofing material with new EPDM roof on tapered insulation
 - Install (6) new condenser units (Size: 4' - 4" L x 3' - 4" W x 3' - 8" H) at a center bay of roof
 - Modify existing shaft penetrations
 - Add new mechanical shaft penetration at east edge of roof directly adjacent and to the rear of existing mechanical shaft
- **Site Work**
 - South
 - Replace existing sidewalk in front of building
 - Install stamped concrete (color not specified) at building entrance
 - West
 - Remove existing sloped concrete driveway/alley to create a level surface aligned with the grade at Congress Street
 - Pour new scored concrete pad at alley
 - Install areas of stamped concrete within the concrete alley pad (color not specified) to match that at building entrance
 - Erect new concrete retaining wall at rear of building to mitigate grade change between front of building at Congress Street and the rear alley
 - Install new concrete stair with metal rail at west edge of alley to mitigate elevation change between alley and grade at the adjacent parcel
 - North/West Corner
 - Erect new trash compactor enclosure

STAFF OBSERVATIONS

- When completing the routine site visit in preparation for the staff report, staff observed active exterior work including the removal and replacement of the existing windows at the south and west facades. Staff informed the applicant of the observation and requested a written statement as to why the work was started without a COA (see letter attached). The letter states that the applicant was issued a building permit last year which included this work. The Buildings, Safety Engineering and Environmental Department (BSEED) confirmed that a building permit was issued for exterior alterations in the fall of 2018 without the project being forwarded to the HDC staff. The observed window replacement was included in the scope of work covered by the permit.
- In staff's opinion, the existing recessed storefronts at the first floor are indicative of the mid-century design element known as a "piloti," or the replacement of exterior supporting walls with a grid of columns, opening the floor plan up and creating a sense that the building is hovering above the ground—a new aesthetic for the era. The proposed extension of the storefronts to the front façade of the building mass would remove this design element. The modularity and material of the cladding of the south façade (Congress Street) and west façade (alley side) are also considered to be examples of the mid-century design aesthetic. If the existing metal panels at the south façade (Congress Street) are porcelain enameled, painting them as proposed will potentially alter both the color and level of "sheen" at that façade.
- It is unknown as to whether or not the west façade (side alley) of the building was originally painted. Staff is concerned about the proposal to leave the brick at the west façade unpainted following the proposed power washing of the existing paint. If the building was originally painted, it should remain painted. If the building was originally unpainted, it may be able to return to its unpainted finish depending on the condition of the original brick surface. If the face surface of the brick is damaged and the interior material of the brick exposed, the brick is vulnerable to moisture penetration and deterioration. If the face surface of the brick is intact and solid and the applicant is choosing to remove the existing paint, the paint should be removed using the gentlest means possible to prevent the compromise of the weather-proof surface of the brick. (See attached National Park Services Preservation Briefs and excerpts from the Secretary of the Interior's Standards Illustrated Recommendations for Rehabilitation)

ELEMENTS OF DESIGN

- (1) **Height.** The thirty-six (36) buildings in the district range in height from two (2) to forty-seven (47) stories tall; the average being twelve (12) stories tall. The row of four (4) to five (5) story Victorian buildings on the east side of Woodward Avenue is sandwiched between single, taller buildings on each of its two (2) corners. The prominent skyline-defining buildings on Griswold Street range in height from eighteen (18) to forty-seven (47) stories tall; buildings in the blocks between Shelby Street and Washington Boulevard are ten (10) or fewer stories, with the exception of the Detroit Bank and Trust Tower at 211 West Fort Street, which is twenty-eight (28) stories. In general, there is little uniformity of building heights within the district.
- (2) **Proportion of building's front façade.** The proportions of individual front façades vary greatly within the district. Buildings over ten (10) stories tall are significantly taller than wide, and are usually located on corners of blocks or occupy their entire block. Most other buildings in the district are also taller than wide, with notable exceptions of several buildings facing Fort Street, the Detroit Fire Department Headquarters at 250 East Larned Avenue, and a few smaller buildings on Shelby Street, which are wider than tall or proportionally neutral. The non-contributing building at 501 Woodward Avenue and the building at 611 Woodward Avenue are significantly wider than tall. Buildings with front-facing light courts, such as the Dime Building at 719 Griswold Street, appear to have two tall tower projecting upward from a single, multi-story base. The façades of the neoclassical style First National Building at 660 Woodward Avenue follow the irregular footprint of its site, and because of its substantial height, provide a backdrop to the small-scaled buildings adjacent to it on Woodward Avenue. Skyscraper buildings of the Art Deco style have multiple setbacks in their wall surfaces as the buildings rise, with faceted and decorative results. The Detroit Free Press Building at 321 West Lafayette Boulevard is composed of a center tower with two lower wings, neutralizing its proportions. Tall buildings of the International style tend to rise as a single slab. Where buildings that are individually taller than wide either share a party wall or abut each other, they may collectively form a row that is wider than tall, particularly on the east side of Woodward Avenue.
- (3) **Proportion of openings within the façades.** The buildings within the Historic Detroit Financial District are each composed of approximately thirty-five (35) percent to sixty (60) percent openings in their front façades. Shapes and sizes of openings generally depend on the style and age of the buildings. Entrances are often centered prominently on the front façades, with revolving doors set back in an arched, covered area of portico. Large openings above the entrance openings, ground floors,

and mezzanine levels in the base of the buildings frequently contain subdivided windows rising up through multiple stories. Plate glass storefront and display windows on the ground floors of commercial buildings are commonplace. Above the ornate bases of Neoclassical and Art Deco buildings and simpler Victorian buildings are rows of doublehung sash windows that are twice as tall as wide and are often arranged in pairs or triples, sometimes divided vertically by spandrels. Subdivided glazing is often situated within large, ornate arched, square or rectangular openings in the attic stories. Replacement windows that are fitted to existing openings are common in the district. Some International style buildings with curtain wall construction feature undivided faces of fixed pane glass, or individualized treatments, such as hexagonal shaped window glass in precast concrete frames of One Woodward Avenue.

- (4) ***Rhythm of solids to voids in the front façades.*** Most buildings in the district are of steel-frame construction, which creates a structure for which windows are inserted in a regular arrangement of columns and rows between the base floor and the attic. The regular rhythm of windows arranged one over the other in a grid pattern prevails throughout the district. The base and attic stories of buildings are varied in architectural treatment, but may feature regular rhythms of arched, square or rectangular openings on first and attic stories. The Detroit Fire Department Headquarters at 250 West Larned Street features double firehouse doors within arcaded openings on its Washington Boulevard and West Larned Street Façades. The International style building at 611 Woodward Avenue features a checkerboard pattern of window placement, while the Federal Reserve Bank Annex at 160 West Fort Street features alternating horizontal bands of glass and marble panels supported by a stainless steel grid above its all-glass tall first story. In general, the district displays a variety of regularly arranged fenestration patterns.
- (5) ***Rhythm of spacing of buildings on streets.*** Rhythm of spacing on streets is generally determined by setbacks from the side lot lines. Buildings consistently abut each other throughout the district; public rights-of-ways separates stretches of adjacent buildings when they occupy partial or entire blocks. Where there are parking lots as a result of building demolition, the original rhythm is broken.
- (6) ***Rhythm of entrances and/or porch projections.*** Most primary entrances are prominently centered on their front façades, especially on the classically derived buildings, and are commonly recessed within single or multiple ornamental openings. Some buildings have colonnades or monumental porticos, with their entrances set behind. international style buildings often have entire base stories recessed behind a colonnade of piers. The Guardian Building at 500 Griswold Street has its main entrance at its northwest corner, and Victorian commercial buildings along Woodward tend to have entrances to the sides of storefronts. Some corner buildings have corner entrances. Most entrances are at grade, with the exceptions of the buildings at 611 Woodward Avenue and the west elevation of 211 West Fort Street, which each feature a set of steps that rise with the slope of their sites, and United States District Court at 231 West Lafayette Boulevard, which sits on a high basement and has steps leading to its main entrance.
- (7) ***Relationship of materials.*** A great variety of building materials exist throughout the district, with concentrations of finished, pressed or glazed brick, limestone, Mankato stone, terra cotta, marble; cast and porcelain enamel and glass facing primary façades. Base stories are commonly faced or partially faced in granite,. Materials utilized for window surrounds and frames are cast concrete, steel, aluminum, bronze and wood. Architectural embellishments tend to be in cast and carved stone, glazed terra cotta, Pewabic tile, and red sandstone. Common brick appears on side elevations that were not intended to be visible. Bronze grills, metal fire escapes, and aluminum and steel framing elements are also visible. In general, the district is rich in its varieties and relationships of materials.
- (8) ***Relationship of textures.*** The smooth surfaces of glazed or painted brick, glazed terra cotta, polished marble, polished granite, and large expanses of glass contrast with the matte finishes of limestone and unpainted brick with mortar joints. Where the basis of buildings are rusticated, they contrast with the smoother wall surfaces above. Repetitive pilasters and ornamental detail in masonry, terra cotta or metal, primarily on belt courses and cornices, and the fluting of columns, contribute significantly to textural interest. Subdivided window sashes and treatments also contribute to textural interest, as do receding windows and wall planes, resulting in textural effects created by light and shade. Where those International style buildings have glass basis, a smooth, transparent textural effect results. In general, the district is extremely rich in textural relationships.
- (9) ***Relationship of colors.*** Major materials or light colors, such as beige, white, and cream, dominate the district. The natural brick colors of red, orange, and buff are also contrasted with beige or light gray trim elements and details. Painted brick, where it exists on the east side of Woodward Avenue, is in dark red and cream. Granite bases, where they exist, are black, red or gray. Window surrounds and sashes are shades of green, black, cream or white. Window and curtain wall glass is either colorless or tinted in shades of light green, black or gray. Stainless steel and aluminum are silver in tone; grills and grates are green or black. The Guardian Building at 501 Griswold Street is a historic landmark featuring orange brick and colored tile light poles tend to be deep green, black or gray. Fire escapes, where they exist, are generally painted black. The original colors of any building;, as determined by professional analysis, are always acceptable for that building and may provide guidance for similar buildings.
- (10) ***Relationship of architectural details.*** The styles of the buildings comprising the Historic Detroit Financial District range from Victorian commercial to International style; their architectural elements and details relate to their styles. Entrance bays, architraves, base stories, window frames, spandrels and cornices or attics are areas of the façades where architectural detail

is concentrated. The small scale Victorian commercial buildings, concentrated on the east side of Woodward, have modified storefronts on their first floors and have lost their cornices and window hoods, greatly simplifying their original appearance. Approximately half of the buildings in the district are derived from classical styles, with an abundance of Neoclassical style buildings, a style well suited to judicial and financial institutions. Those classically inspired buildings are articulated as a base (bottom), shaft (midsection) and attic (top). The base, often multi-storied, is heavily ornamented around the main entrance with columns, arches, and architectural sculpture. Several buildings have rusticated stone bases, and some display colossal porticos. The shafts contain regular fenestration with ornamented spandrels, and their attics, including their cornices, are heavily ornamented. Art Deco commercial buildings are concentrated on Griswold Street, and in addition to their embellished entrances, feature setbacks at upper floor levels that are embellished, resulting in dramatic silhouettes that are part of their design. These Art Deco buildings also exhibit decorative tile work, mosaics, and large-scale architectural sculpture. International style buildings of the 1950s and early 1960s are concentrated on the east side of Woodward Avenue through to Griswold Street, and intermingled with classically inspired buildings on West Fort Street. They feature transparent first stories of glass that are visible to the interior, and are set in back of piers supporting the upper stories. Flagpole basis, lighting, and street names integrated with the larger buildings are treated decoratively. In general, the architectural detail on buildings in the district is very rich.

- (11) ***Relationship of roof shapes.*** All of the buildings have flat roofs that cannot be seen from the ground. Utility penthouses and/or equipment enclosures are sometimes visible above the roofline, and are sometimes ornamentally treated.
- (12) ***Walls of continuity.*** Walls of continuity within the district are primarily created by the adjacent buildings with uniform elements, such as setbacks, materials, and styles. Except where broken by vacant lots, the district has a very high degree of continuity. Secondary wall of continuity are created by evenly spaced lighting fixtures, sidewalks and rows of trees along the sidewalks.
- (13) ***Relationship of significant landscape features and surface treatments.*** Throughout the district, sidewalks are concrete and roadbeds are asphalt, with the primary exception of brick-paved areas around Campus Martius at the northeast corner of the district. Street furniture is abundant throughout the district; planter boxes for trees are positioned along the public sidewalk on the west side of Woodward Avenue and the north side of West Fort Street, and in-ground trees line the east side of Griswold Street within stylized metal grates reflecting the geometric designs of the Guardian Building at 500 Griswold Street. Wall-mounted lighting fixtures are often integrated with the designs of the buildings and are situated at the tops of first story pilasters to illuminate the pedestrian way. Also sometimes integrated with the taller buildings is lighting at the upper extremities that identify the buildings from afar, such as the flashing red globe of the Penobscot Building at 645 Griswold Street, the reproduction street lighting along Woodward Avenue consists of a tall steel ornamental, fluted pole carrying a double pendent and lanterns. On Griswold Street, the lighting consists of old metal fluted poles with more recent lanterns. Old ornamental poles exist along Washington Boulevard south of Michigan Avenue; the modern steel pole mounted variety is seen elsewhere. Some buildings have modern spotlights attached to light posts directed at their façade. Slender black, metal kiosks with directional information and a map are strategically placed at some prominent corners. Surface parking lots are few and provide intrusions to the otherwise dense concentration of buildings where they exist. Concrete columns supporting the Detroit People Mover are situated in the public rights-of-way on West Larned Street as well as Cass Avenue. A bronze sculpture is positioned at the plaza in front of 1 Woodward Avenue; another is positioned at the extreme southeast boundary of the district at Woodward Avenue and Jefferson Avenue; another is positioned in the space between 211 and 201 West Fort Street. A plaza with raised planting beds exists in front of the Annex of the Federal Reserve Bank at 160 West Fort Street. The curbed, landscaped median on Woodward Avenue identifies the roadway as Detroit's major thoroughfare.
- (14) ***Relationship of open space to structures.*** In general, the financial district is densely built-up; open space results from interruptions by public streets and alleys, and by a few intrusive surface parking lots. Awnings and canopies commonly extend into the public rights of way throughout the district. Signage bearing the name of the businesses of the Victorian buildings on the east side of Woodward Avenue is situated in a frieze above the first story. Elsewhere in the district the historic name of the building is commonly integrated with its original design while the names of current occupants are displayed on vertically oriented signs hanging at the corners of the buildings above the first story. The building at 611 Woodward Avenue bears its name of the roof penthouse screen. Skywalks connect buildings when their ownership is or was related, connecting One Woodward Avenue with 500 Woodward Avenue, commonly known as the Guardian Building; 151 West Fort Street, commonly known as the State Savings Bank Building, with 607 West Shelby Street; and 201 West Fort Street with 211 West Fort Street. Wheelchair ramps provide access to an entrance on the Larned Street elevation of the Detroit Fire Department Headquarters at 250 West Larned Street and to an entrance on the Lafayette Boulevard elevation of the Federal Courthouse at 231 West Lafayette Boulevard.
- (15) ***Scale of façades and façade elements.*** The façades range from small in scale to monumental. Small-and-medium scaled buildings that contribute to the continuous streetscapes contrast with the large scale of skyscrapers that define Detroit's skyline. Elements and details are often monumental, such as porticos, colonnades, architectural sculpture, and large openings, and are meant to provide a grand presence when seen from upfront and afar.
- (16) ***Directional expression of front elevation.*** The directional expression of individual front façades varies throughout the

district, but generally, the expression of buildings on Woodward Avenue tends to be horizontal, with the exception of One Woodward Avenue and the First National Bank Building at 660 Woodward Avenue, which are vertical. On Griswold Street, where several prominent Art Deco skyscrapers exist, the overall directional expression is vertical. However, where buildings share party walls or one another, or are separated by narrow alleyways, the horizontal, or pedestrian, nature of the streetscapes is emphasized.

- (17) ***Rhythm of Building Setbacks.*** Most buildings occupy their entire building parcels, resulting in uniformity of building setbacks. On the west side of Woodward Avenue, the buildings are set back, allowing for a generous public sidewalk with amenities. The Detroit Fire Department Headquarters at 250 West Larned Street is set back slightly on its two visible elevations to allow the fire trucks space to exit. Wherever a newer building is connected to an older building, particularly on West Fort Street, the newer International style buildings are set back and landscaped plazas are created.
- (18) ***Relationship of lot coverages.*** Lot coverage by the buildings in the district is generally one hundred (100) percent, as the vast majority of buildings occupy their entire lots. In the cases where a public outdoor amenity exists, its features are integrated with the design of the building.
- (19) ***Degree of complexity within the facades.*** The district contains facades with various degrees of complexity, depending on style. The Victorian commercial and Neoclassical buildings are straightforward in their massing, fenestration, and architectural detail. The Art Deco skyscrapers appear more complex in their details and ornamentation, but especially in their massing as the setbacks of the upper stories display different massing and heightened detail. Modern buildings may appear straightforward in their design but are complex in their geometric forms, use of materials, and subtle detail.
- (20) ***Orientation, vistas, overviews.*** The Historic Detroit Financial District is a densely built up district of commercial and governmental buildings in Detroit's Central Business District on lower Woodward Avenue and west of Woodward Avenue. Its proximity to Detroit's Civic Center, the Detroit River, the Washington Boulevard and Capitol Park Historic Districts, Cadillac Square, and Campus Martius provide dramatic views and vistas. Detroit's skyline is composed of the silhouettes of the tallest buildings in the district, while West Congress Street provides a cavernous quality to a relatively narrow street.
- (21) ***Symmetric or asymmetric appearance.*** While individual buildings display a high degree of symmetry in their major facades, the district on the whole is diverse in its array of quality building designs.
- (22) ***General environmental character.*** The Historic Detroit Financial District consists of a dense cluster of major, architect-designed commercial buildings in an eight-block, grid-plan section of downtown Detroit just north of Hart Plaza and the Detroit River. Its historical importance is emphasized by its number of iconic buildings that make up Detroit's skyline, and its smaller buildings that result in a walkable downtown. The Detroit Department of Transportation-operated bus system and the People Mover provide transportation in and around the district providing ease of access to major sporting events, conventions, and restaurants, in addition to the historic buildings that are destination in and of themselves.

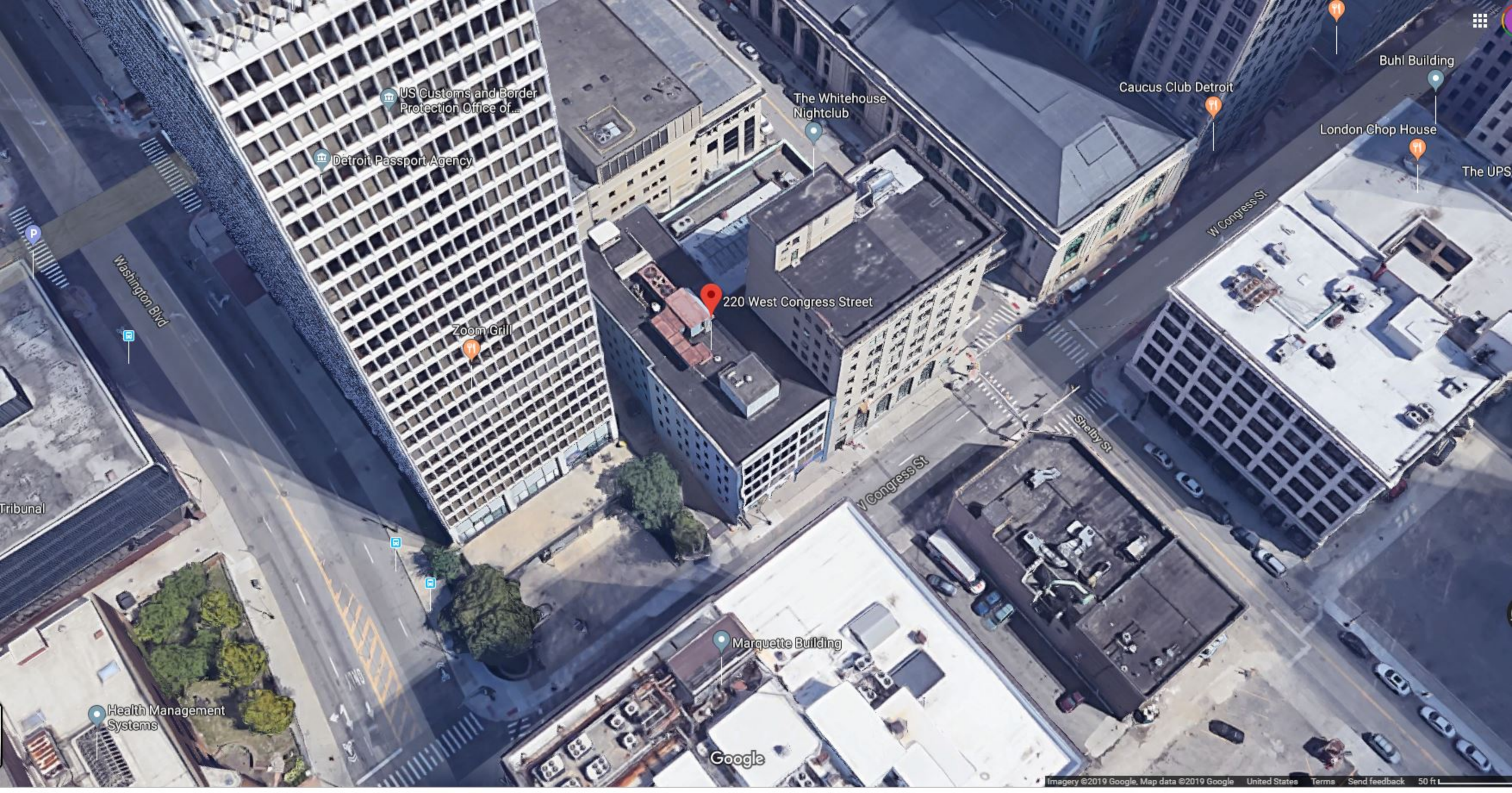
RECOMMENDATION

It is staff's opinion that all work – other than the proposed power-washing of the brick and leaving the brick exposed at the west façade – as proposed, does not destroy historic materials that characterize the historic building, its site, and setting. Staff therefore recommends that the Commission find the general rehabilitation of the building as proposed to be appropriate as the scope of work meets the following Secretary of the Interior's Standards for Rehabilitation:

- 9) *New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.*

Given the uncertainty as to whether the brick at the west façade was painted or unpainted originally, staff is withholding a recommendation for the treatment of the wall.











Shelby

DO NOT
BLOCK
INTERSECTION

DO NOT
BLOCK
INTERSECTION

AVAILABLE
Jasper Hanft
Brendan George
+1 248 353 5400
CBRE

AVAILABLE
Jasper Hanft
Brendan George
+1 248 353 5400
CBRE

800
763
3999



Shelby

DO NOT
BLOCK
INTERSECTION





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313-628-0094

Anne,

Regarding your question in the current work being done on the 220 Congress building; the project was granted a building permit last year and that is the permit that it is being developed under. There were changes made to the mechanical systems and alley layout, mostly, that prompted us to submit the revisions to the building department.

I hope this clarifies things.

Feel free to contact me with any questions.

Thanks,

A handwritten signature in cursive script, appearing to read "Dorian A. Moore".

Dorian

Dorian A. Moore
Vice President
Archive DS



220 Congress Remodeling Project Narrative

Owner: Basco

607 Shelby St., suite 400
Detroit, MI 48226

Architect: Archive DS

615 Griswold St., suite 1710
Detroit, MI 48226

Project Description:

The adaptive reuse of one (1) five (5) story existing building, located at 220 Congress St., detroit, Michigan, into first floor "white box" commercial space, "white box" office space on second through fifth floors. First floor commercial spaces to have access to a side alley redevelopment.

Exterior work will include, generally: Painting of existing south-facing metal panel facade, replacement of damaged metal panels at ground floor level, Tuckpointing and repair of masonry on the west, north, and east facades. The existing paint on the brick portion of the west facade will be power washed to achieve a weathered appearance. The work also includes replacement of existing windows on all elevations. The windows are being replaced to install more current, energy efficient windows with a similar profile to the existing windows.

The redevelopment of the existing alley into a public space is included as part of the work. Because the alley will be redeveloped as a public space, the owner has proposed new window and door openings along the west facade at the first floor level.

Detailed Scope of Work:

- Paint existing south (main) facade
- New windows and storefront at existing south facade
- Expansion of storefront space to enclose existing setback area on south facade
- Paint existing synthetic stucco portion of west facade
- Powerwash off paint from brick at west facade to achieve a weathered appearance
- New windows and storefront at existing west facade for access to alley
- New windows at existing north and east facades
- New paint color at existing north and east facades

Existing brick- painted

PARTIAL EAST ELEVATION



Existing Metal Panel

SOUTH ELEVATION

Existing brick- painted

NORTH ELEVATION



DETAIL @ SUBWAY ENTRANCE



Existing brick- painted

Location of new window and door

WEST ELEVATION NORTH PORTION

Existing synthetic stucco- painted

Location of new window and door

Location of new window

WEST ELEVATION SOUTH PORTION

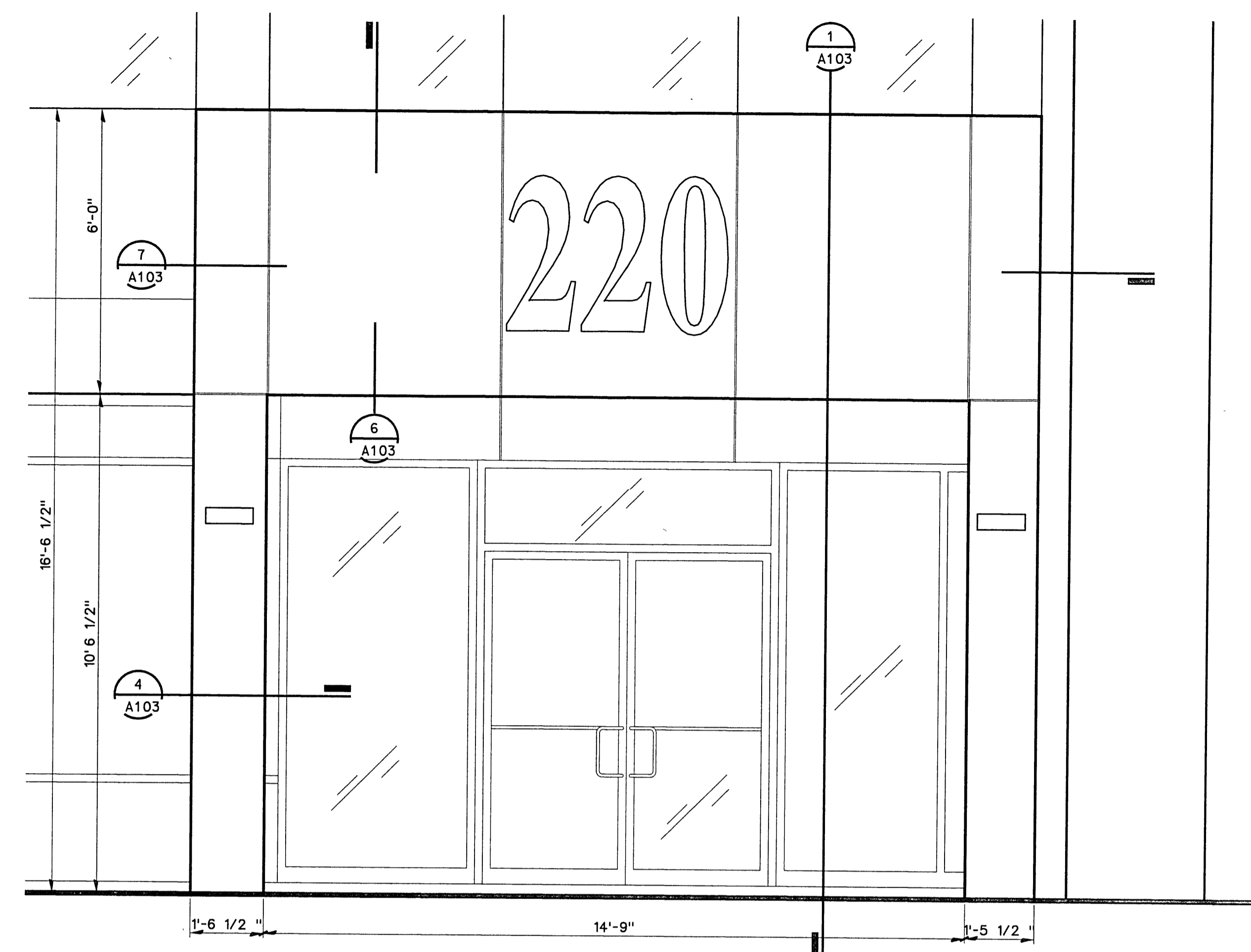
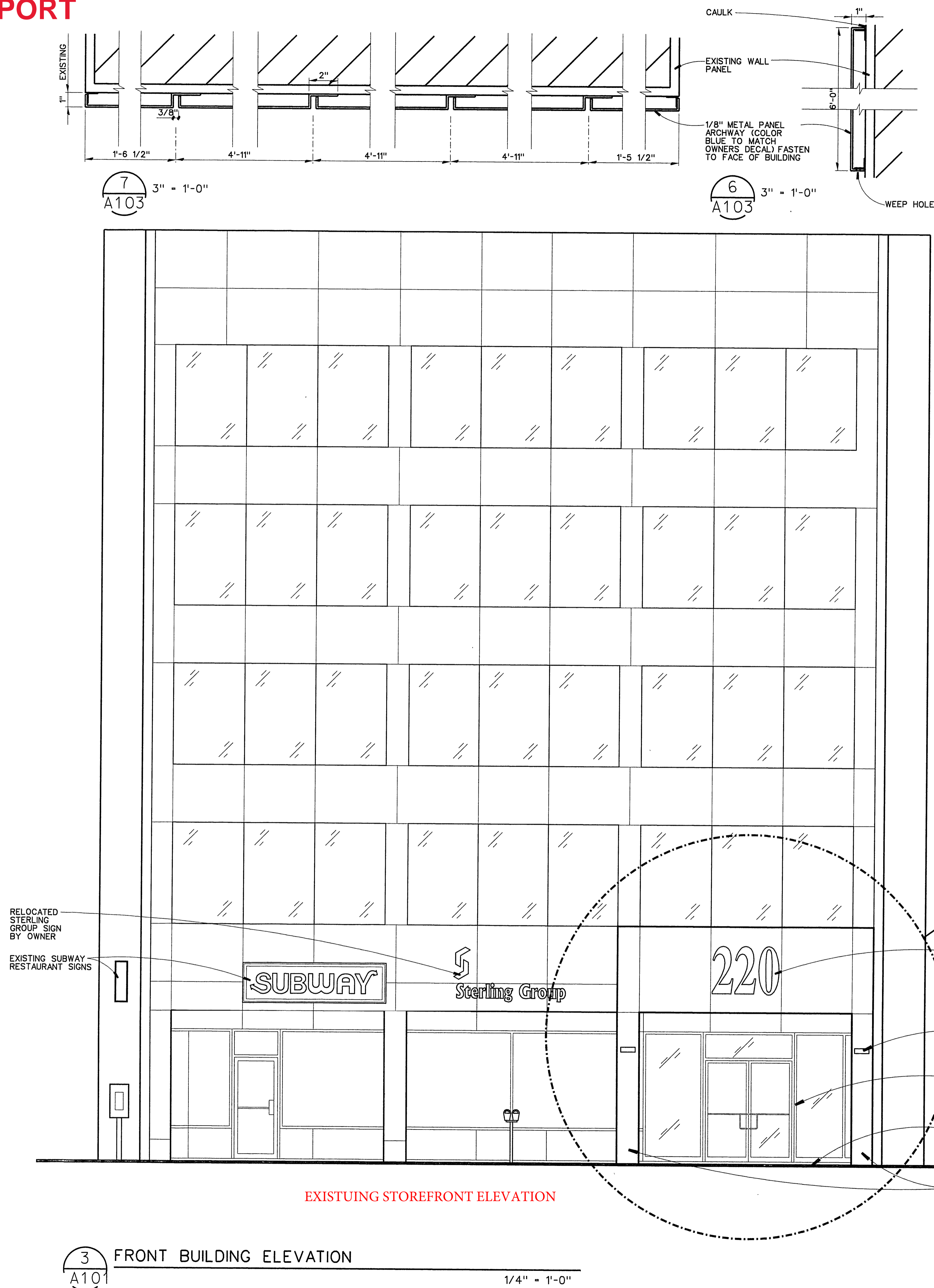


220 W.Congress Remodeling
220 W. Congress St., Detroit, MI
BASCO

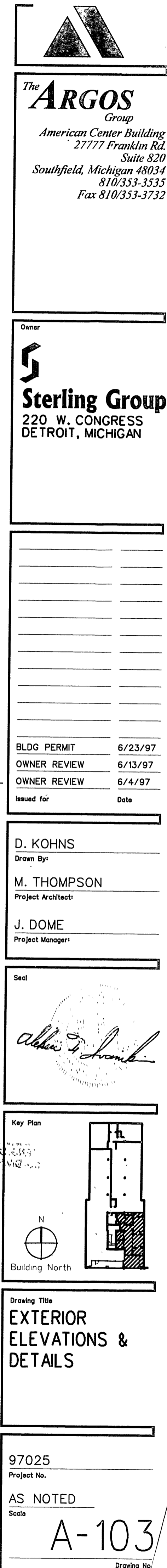
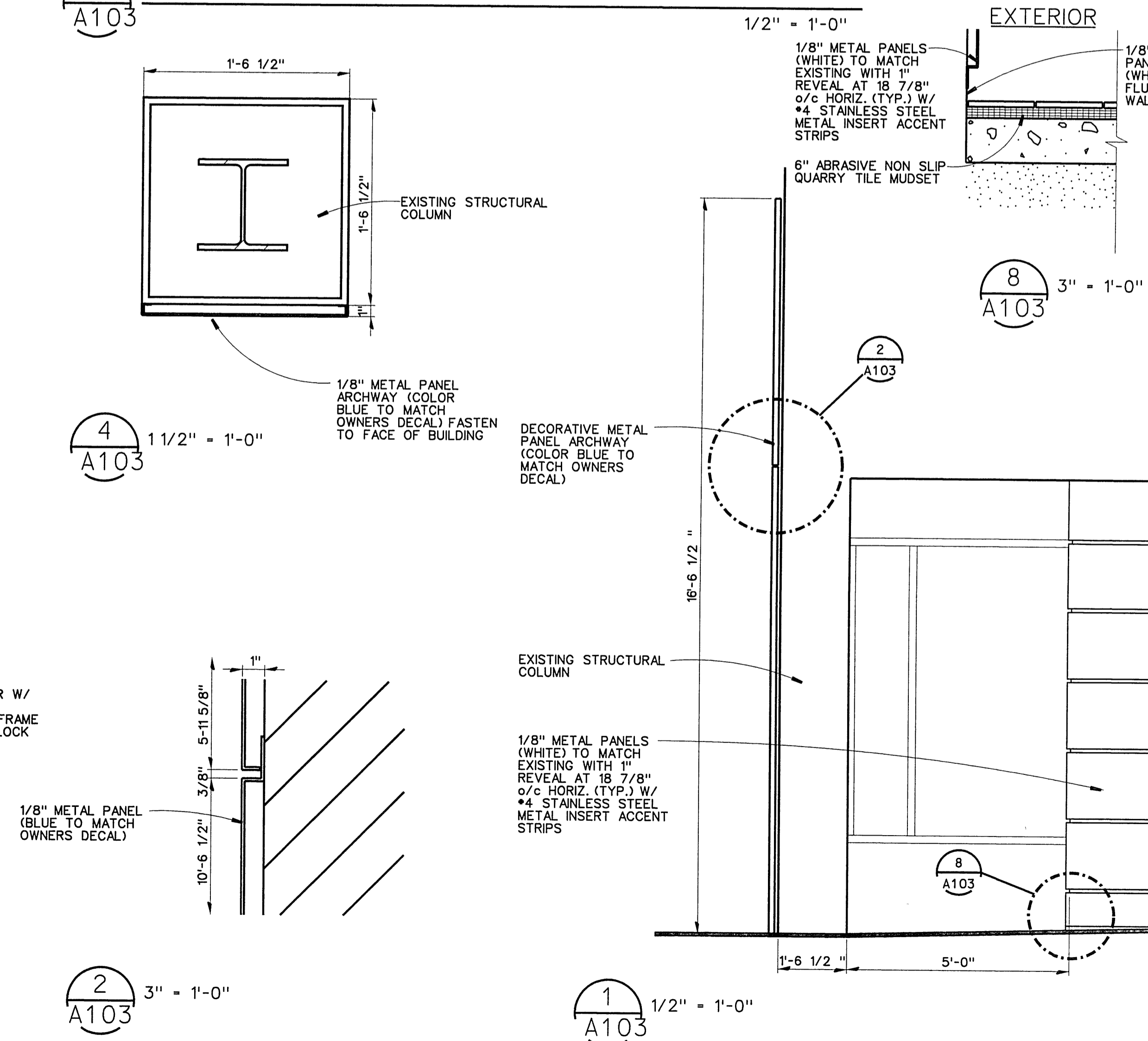


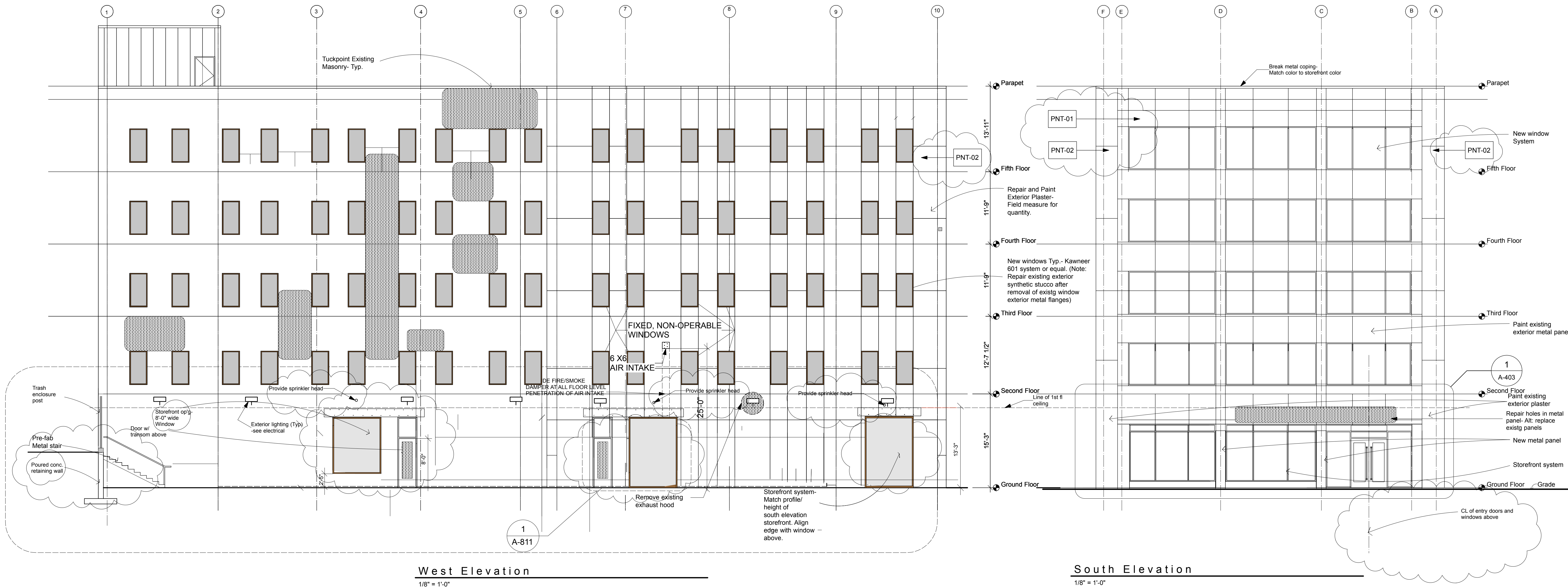
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KLAETKE + MARINO, ARCHITECTS DATE: 1/2/78
 608 FINE ARTS BUILDING 55 W. ADAMS DETROIT MICHIGAN 48226 WOODWARD 2-3735 SHEET: 11

REPORT



5 FRONT ENTRY
A103





CURRENT SCOPE

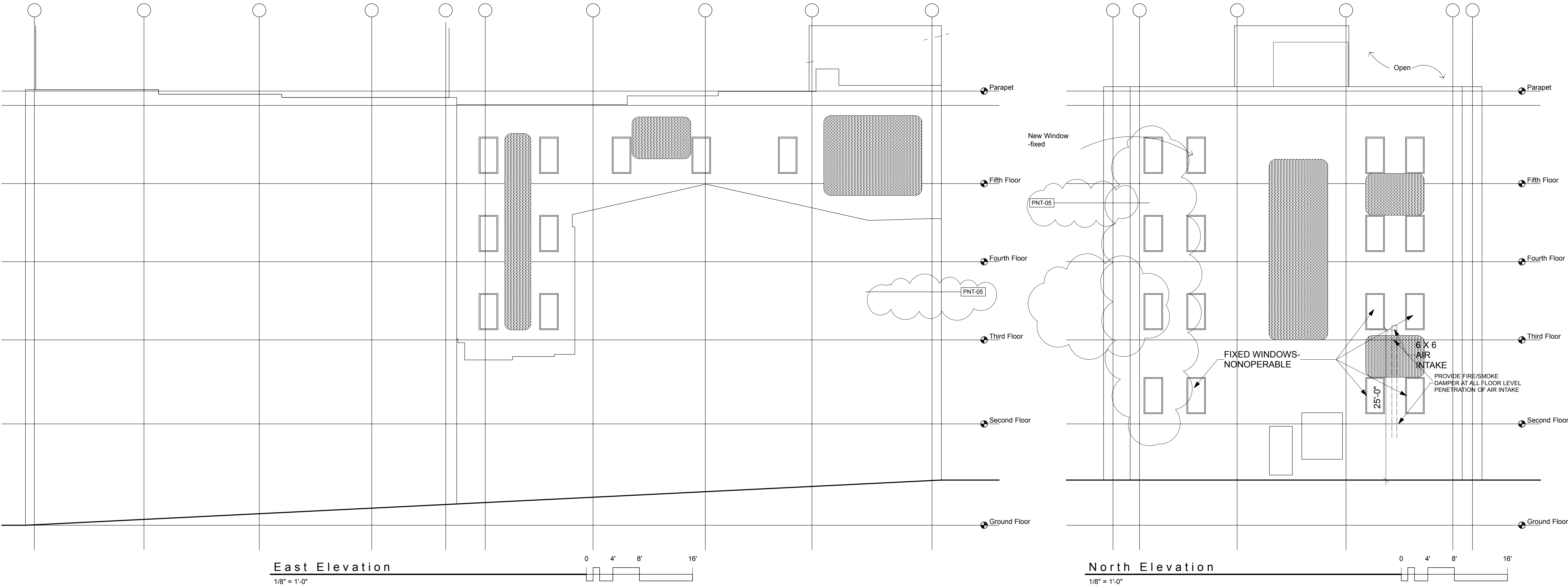
220 W. Congress Remodeling
220 W. Congress St., Detroit, MI
BASCO

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Exterior Elevations

Issued For:	
Interim Des. Dev.	091417
Des. Dev.	101917
Review	050818
BIDS	062518
PERMITS	08.17.18
REVISION	10.05.18
REVISION	12.07.18
COORDINATION	01.30.19
BULLETIN #2	03.01.19
COORDINATION	03.15.19
REVISION #1	05.02.19
REVISION #2	06.12.19
Permit revision	07.11.19
HDC Request	07.17.19

Drawn: KC
Checked: DM
Approved: DM
Project Number:





CURRENT SCOPE

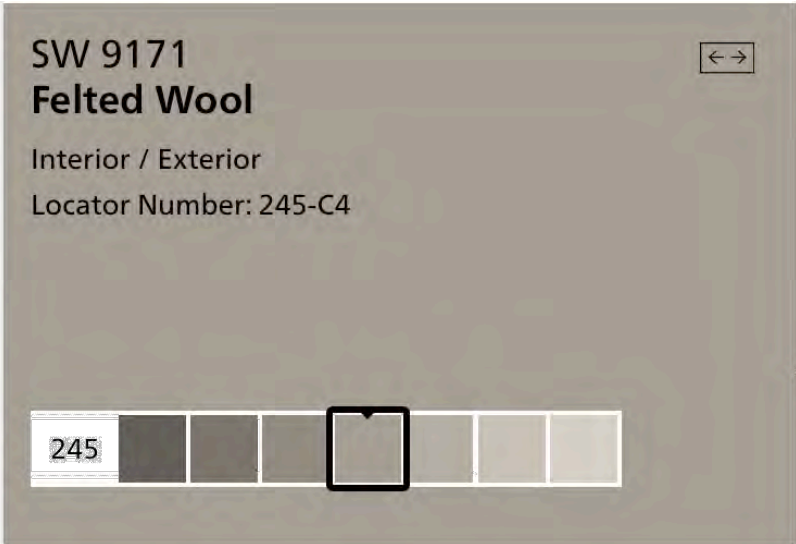
220 W. Congress Remodeling
220 W. Congress St., Detroit, MI
BASCO

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Exterior Elevations

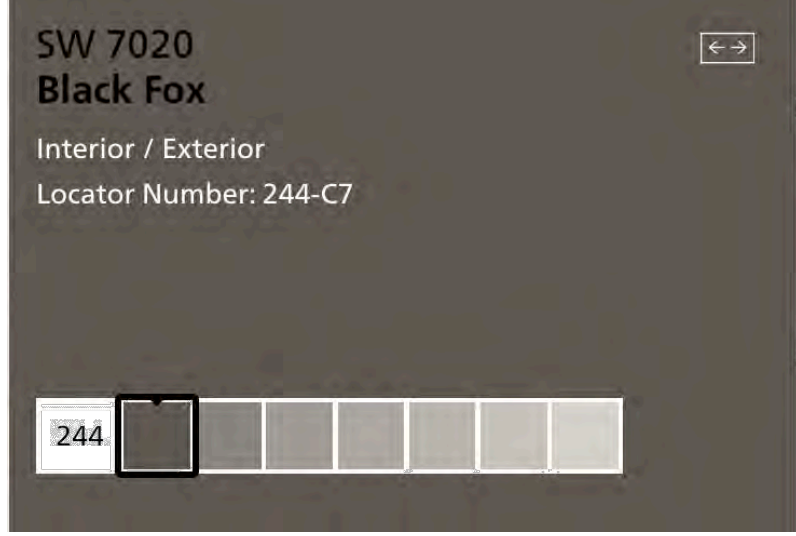
Issued For:	
Interim Des. Dev.	091417
Des. Dev.	101917
Review	05.08.18
PERMIT COMMENTS	10.05.18
BULLETIN 1	12.28.18
COORDINATION	01.30.19
COORDINATION	03.07.19
REVISION 2	06.12.19
HDC Request	07.17.19

Checked:	
Approved:	
Project Number:	
Date:	8 May 2017

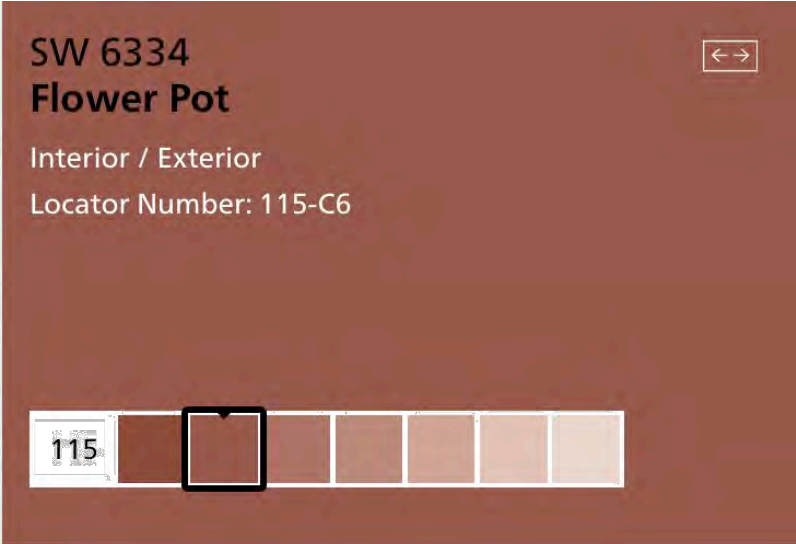


PAINT SCHEDULE

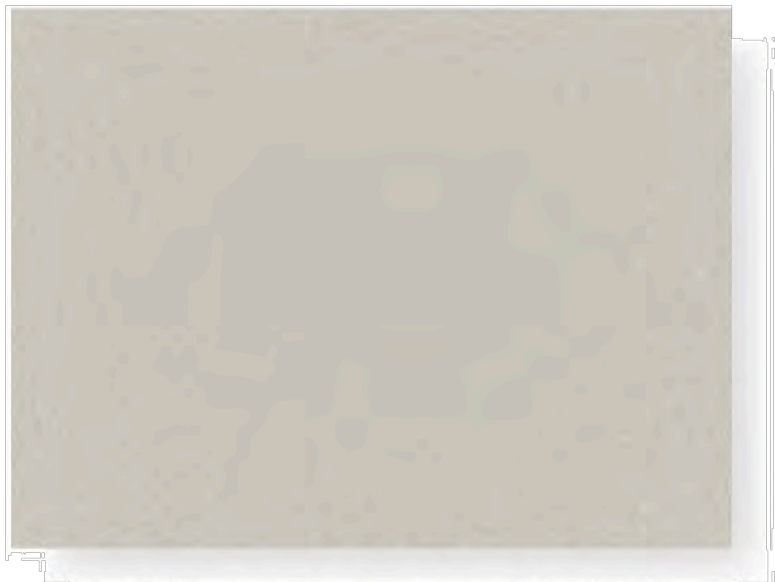
PNT-01: PAINT-EXTERIOR MET. WALLS
SOUTH ELEVATION
SHERWIN WILLIAMS
SW 9171 "FELTON WOOL"



PNT-02: PAINT-EXTERIOR STUCCO
SOUTH AND WEST ELEVATION
SHERWIN WILLIAMS
SW 7020 "BLACK FOX"



PNT-05: PAINT-EXTERIOR BRICK WALLS
NORTH AND EAST ELEVATION
SHERWIN WILLIAMS
SW 6334 "FLOWER POT"



Champagne Gold
399A540

SOUTH ELEVATION WINDOW AND STOREFRONT FRAMES



#40

DARK BRONZE

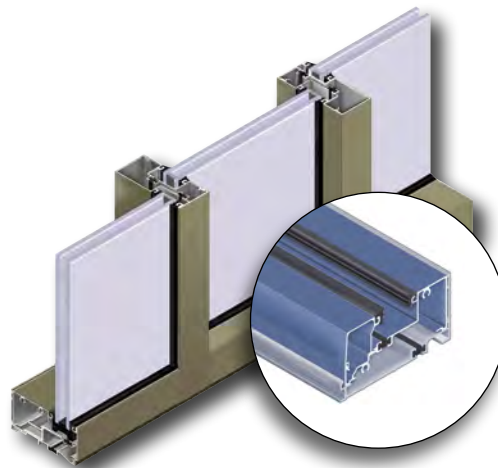
WEST, EAST, AND NORTH ELEVATION WINDOW
AND STOREFRONT FRAMES



STOREFRONT AND WINDOW SYSTEM DETAIL VIEW
SCALE: NTS

Series 3000 Thermal Multiplane— the versatility of standard storefront systems with improved thermal performance

The Series 3000 Thermal Multiplane extends the versatility of standard storefront systems by offering **improved thermal performance** and multiple glass plane options. The Series 3000 Thermal Multiplane provides more options for head and sill anchorage, **structural silicone glazing** and a front set installation option utilizing continuous head and sill members. Designed for 1" infill, the Series 3000 Thermal Multiplane has available glazing adapters and gasket options for infills ranging from 1/4" to 1-1/8".



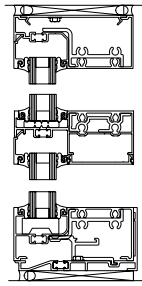
First Community Credit Union, St. Louis, MO
Architect: TR,i Architects

Features

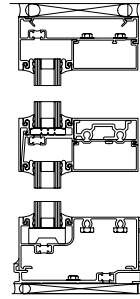
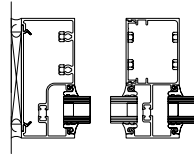
- Overall system dimensions: 2" x 4-1/2"
- Front Set, **Center Set**, Back Set or Multi Set glazing configurations
- Optional sill receptor requires no additional anchoring of sill member
- Optional thermally broken head anchor clip
- SSG glazing with patented funnel bridge option for Front Set
- Continuous head and sill assembly option for Front Set
- Screw spline and shear block assembly
- Outside and inside glazing options Complete
- 90° and 135° corners
- High sidelite base
- Thermally broken members with polyurethane thermal breaks
- Accommodates projected and casement vents
- Factory painted Kynar 500®/Hylar 5000® finishes, meeting all provisions of AAMA 2605
- Factory anodized finishing



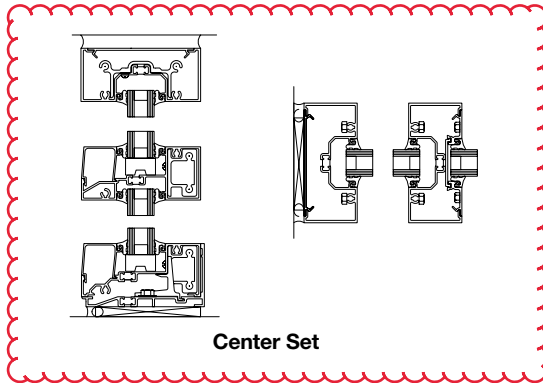
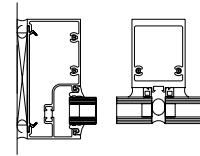
Product Details



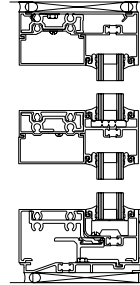
Front Set



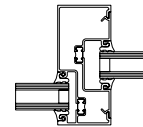
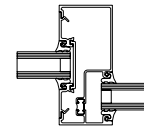
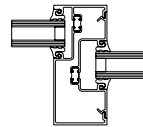
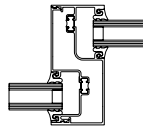
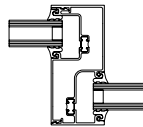
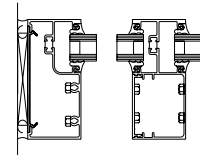
Front Set SSG



Center Set



Back Set



Multi Set

Performance

- Air Infiltration: <.06 CFM/SQ FT @ 6.24 PSF per ASTM E283
- Static Water: 10 PSF per ASTM E331
- Deflection Load: 40 PSF per ASTM E330
- Structural Load: 60 PSF per ASTM E330
- STC per ASTM E90:
 - 32 with clear glass (Center and Front Set)
 - 37 with laminated glass (Center Set)
 - 38 with laminated glass (Front Set)
- OITC per ASTM E90:
 - 26 with clear glass (Center and Front Set)
 - 30 with laminated glass (Center and Front Set)
- Thermal Performance per AAMA 1503 for Low-E 1" insulating glass:
 - U-factor = 0.33, CRF = 68 Captured (Front Set)
 - U-factor = 0.31, CRF = 72 Captured (Front Set SSG)
 - U-factor = 0.32, CRF = 63 Captured (Center Set)
- NFRC Certified and Thermal Performance Characteristics per AAMA 507



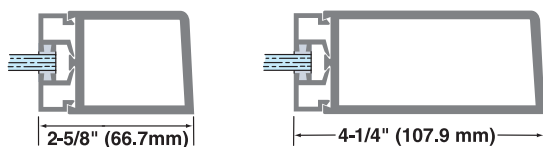


Oldcastle BuildingEnvelope™ — a market leader in Standard Entrances

Oldcastle BuildingEnvelope™ offers standard, narrow, medium and wide stile entrances to **meet a broad range of traffic** requirements. All standard Oldcastle BuildingEnvelope™ entrances (3' wide) are ADA compliant and have built-in features.

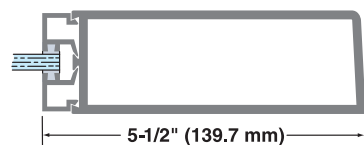
Specifications

Oldcastle BuildingEnvelope™ entrances are durable and virtually maintenance free. We also offer a complete line of custom, specialty and all-glass entrances.

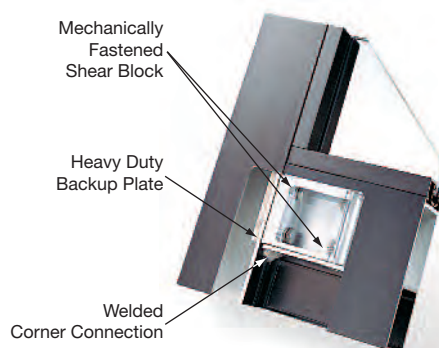


Series 212 – Narrow Stile

Series 375 – Medium Stile



Series 500 – Wide Stile



AT&T Park, San Francisco, CA
Architect: Populous (formerly HOK Sport)

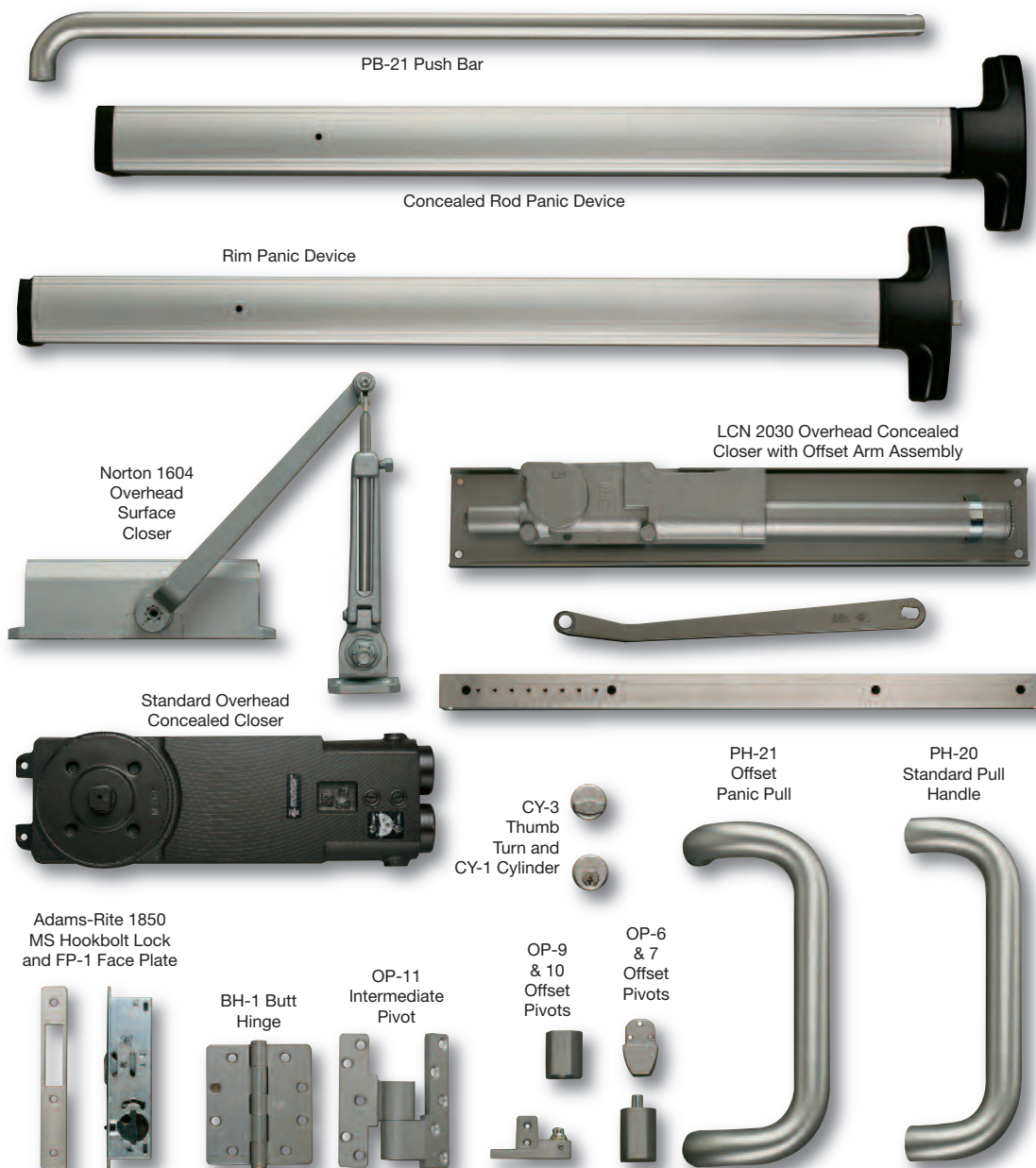
Features

- Maximum security hook bolt locks
- 1" diameter push/pulls
- Adjustable astragal with dual weathering on pairs of doors
- Mechanically fastened shear blocks and welded corner construction
- Adaptable to virtually all hardware
- 4" to 10" one piece bottom rail options
- Glass stops with bulb gaskets
- 1/4", 3/8", 5/8" and 1" glazing options
- Adaptable to meet local building codes
- Limited lifetime warranty



Hardware

Oldcastle BuildingEnvelope™ employs only the finest entrance door hardware available. For more information, call 866-OLDCASTLE (653-2278) or visit oldcastlebe.com.



1200 Fixed

CAD Details Specifications Literature

The 1200-F Fixed window utilizes 9/16” crimped in place rigid PVC thermal break technology allowing for high thermal requirements and dual color and finish combinations.

Product Features

- Frame: 4” depth (available in 5-1/8”, 6” and Arctic system only, 7”).
- Interior-glazed vision area for economical installation. Side-stacking system installs easily, even if pre-glazed.
- Spandrel areas can be exterior-glazed to accommodate back spandrel pans and rain-screen.
- Design can incorporate shadow box and louver conditions.
- Accepts 1” (25.4 mm) thick IGU.
- Rain screen design using exterior Polyshim butyl tape, with a silicone healbead, interior aluminum stops and top-load EPDM gasket.
- This product is supported for the Canadian market only.

Product Performance

- Deflection Load: +/-65 PSF per ASTM E330
- Structural Load +/- 97.5 PSF per ASTM E33
- CSA Rating = B7, C5, I151

CAD Details Click to expand [+] / collapse [-]. Click link on right to download file.

1200 Fixed (PDF) (ZIP)

Specifications

1200 Fixed Specifications (DOC)

Literature

1200 Fixed Product Data (PDF)

(https://obe.com/sites/default/files/resources/1200_fixed_pd.pdf)

Project Gallery



Oldcastle BuildingEnvelope®	Products		Resources
Only one company can provide fully integrated building envelopes. If a building envelope is supposed to end up as one unified system—why cobble it together with disparate parts? Our curtain wall, windows, storefronts, skylights and glass are designed, engineered, tested and manufactured by the same company. Why? It makes buildings better. It saves you time. It reduces your risk. It just makes sense. So why doesn't every manufacturer do it? They can't. There's only one Building Envelope Company.™	New Products (/products/new-products)	Storefronts (/products/storefronts)	Testimonial Case Studies (/testimonials)
	Thermal (/products/thermal)	Entrances (/products/entrances)	Project Gallery (/project-galleries)
	Blast Mitigation (/products/blast-mitigation)	Skylights (/products/skylights)	Media Center (/media-center)
	Hurricane Resistant (/products/hurricane-resistant)	Sun Control (/products/sun-controls)	Product Literature (/product-literature)
	Curtain Wall (/products/curtain-wall)	Architectural Glass (/products/architectural-glass)	Advertising (/advertising)
	Architectural Windows (/products/architectural-windows)	Structural Glass (/products/structural-glass)	Price Book (/resources/price-book-binder)
	Window Wall (/products/window-wall)		Architectural Binder (/resources/architectural-binder)
			Samples (/literature-request)

REPORT



SAMPLE OF STAMPED CONCRETE PATTERN AND COLOR
220 W. CONGRESS



BRICKFORM STANDARD COLORS

Color Cards

The Brickform 40 Standard Colors are available in Color Hardener, Antique Release, Antique-It, Cem-Coat, FreestylePro, Overlay Liquid Colorant, and Tinta' Seal. Disclaimer: This digital color card should be used as a general guide, not a definitive indicator of final color. Shades and hues can vary depending on screen settings. When planning a project, consult a physical color card for a better indication of potential color. Create a representative mockup before any project to better account for the effects of conditions, material, and techniques that may alter the final appearance or color.

 320 Golden Sandstone	 1080 Adobe Buff	 1070 Sandy Buff	 325 Sandstone	 350 Desert Tan
 1030 Ash White	 250 Oyster White	 1090 Sun Buff	 1010 Smokey Beige	 300 Nutmeg
 625 Dover Blue	 615 Stone Gray	 200 Medium Gray	 100 Dark Gray	 815 French Gray
 1040 Weathered Sage	 1045 Shadow Slate	 825 Slate Green	 650 Smokey Blue	 330 Coconut
 735 Cappuccino	 310 Cream Beige	 1035 Summer Beige	 1055 Pecos Sand	 1020 Antique Rose
 1050 Antique Cork	 515 Sunbaked Clay	 700 Terra Cotta	 425 Autumn Brown	 1015 Blush Beige

SELECTED COLOR



375 Buff Tan



525 Dusty Rose



400 Chestnut



810 Walnut



115 Venetian Pink



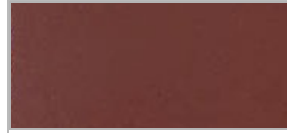
1065 Quarry Red



500 Tile Red



575 Victorian Red



550 Brick Red



PROSOCO®

Enviro Klean®

NEXT GENERATION CLEANERS

EK Restoration Cleaner

Enviro Klean® EK Restoration Cleaner is a concentrated compound for dissolving tough carbon deposits and other atmospheric staining. A practical alternative to conventional acidic cleaners, near-neutral pH EK Restoration Cleaner cleans brick, granite, sandstone, terra cotta, and other masonry.

Safer and less expensive than sandblasting or steam cleaning, it also loosens and dissolves dirt, paint oxidation, and other stains associated with aged and dirty buildings. It is perfect for projects where harsh acid cleaners are not allowed.

ADVANTAGES

- Proven effective for cleaning dirty and heavily carbon stained buildings.
- Safer than sandblasting. Will not pit or damage the masonry when properly applied.
- Does not contain hydrofluoric acid.

Limitations

- Not suitable for cleaning most concrete or marble surfaces. See Sure Klean® Limestone Restorer or Sure Klean® 766 Limestone & Masonry Prewash/Afterwash for these applications.
- Not recommended for interior use. Contact PROSOCO's Customer Care (800-255-4255) for recommendations for the most appropriate interior cleaning system.
- May not be suitable for some polished stone and glazed surfaces.
- Product may bleach certain types of light- or buff-colored masonry materials. Always test.
- May damage glass and architectural aluminum.

REGULATORY COMPLIANCE

VOC Compliance

Enviro Klean® EK Restoration Cleaner is compliant with all national, state and district VOC regulations.

TYPICAL TECHNICAL DATA

FORM	Clear, amber liquid
SPECIFIC GRAVITY	1.06
pH	5.5 in concentrate
WT/GAL	8.82 lbs
ACTIVE CONTENT	not applicable
TOTAL SOLIDS	not applicable
VOC CONTENT	not applicable
FLASH POINT	not applicable
FREEZE POINT	no data
SHELF LIFE	2 years in tightly sealed, unopened container

SAFETY INFORMATION

Always read full label and SDS for precautionary instructions before use. Use appropriate safety equipment and job site controls during application and handling.

24-Hour Emergency Information:
INFOTRAC at 800-535-5053

Product Data Sheet Enviro Klean® EK Restoration Cleaner

PREPARATION

Protect people, vehicles, property, glass, metal, painted and non masonry surfaces from product, splash, residue, rinse fumes and wind drift. Divert or protect pedestrian and auto traffic. When working over traffic, clean only when traffic is at a minimum and protect carefully.

Complete masonry cleaning before replacing windows, doors, hardware, light fixtures, roofing materials, wood and any other non masonry items which may be damaged by the cleaning product. If such fixtures have been installed or are to remain in place, protect before overall application using Sure Klean® Strippable Masking (where appropriate according to product literature) or polyethylene. Be sure that all caulking and sealant materials are in place and thoroughly cured before cleaning begins.

Inspect glazed terra cotta and tile carefully. Where glaze has partially weathered away or previously etched, cleaning may take off more glaze.

Surface and Air Temperatures

Best air and masonry surface temperatures for cleaning are 40°F (4°C) or above. Cleaning when temperatures are below freezing or may be overnight may harm masonry. If freezing conditions existed before application, let masonry thaw.

Equipment

Apply using brush or roller. Applying with high pressure spray drives the chemical deep into the surface, making it difficult to rinse completely. Surface discoloration may result.

Rinse with enough water and pressure to flush spent cleaner and dissolved soiling from the masonry surface and surface pores without damage. Inadequate rinsing leaves residues which may stain the cleaned surface.

Masonry-washing equipment generating 400–1000 psi with a water flow rate of 6–8 gpm is the best water/pressure combination for rinsing porous masonry. Use a 15–45° fan spray tip. Heated water (150–180°F; 65–82°C) may improve cleaning efficiency. Use adjustable equipment for reducing water flow rates and rinsing pressure as needed for sensitive surfaces.

Rinsing pressures greater than 1000 psi and fan spray tips smaller than 15° may permanently damage sensitive masonry. Water flow rates less than 6 gpm may reduce cleaning productivity and contribute to uneven cleaning results.

Storage and Handling

Keep from freezing. Store in a cool, dry place with adequate ventilation. Always seal container after dispensing. Do not alter or mix with other chemicals. Published shelf life assumes upright storage of factory-sealed containers in a dry place. Maintain temperature of 45–100°F (7–38°C). Do not double stack pallets. Dispose of unused product and container in accordance with local, state and federal regulations.

Recommended for these substrates. Always test. Coverage is in sq.ft./m. per gallon of concentrate.			
Substrate	Type	Use?	Coverage
Architectural Concrete Block	Burnished	no	N/A
	Smooth	no	
	Split-faced	no	
	Ribbed	no	
Concrete	Brick	no	N/A
	Tile	no	
	Precast Panels	no	
	Pavers	no	
	Cast-in-place	no	
Fired Clay	Brick	yes	125–200 sq.ft. 12–19 sq.m.
	Tile	yes	
	Terra Cotta	yes	
	Pavers	yes	
Marble, Travertine, Limestone	Polished	no	N/A
	Unpolished	no	N/A
Granite	Polished	no	N/A
	Unpolished	yes	175–250 sq.ft. 16–25 sq.m.
Sandstone	Unpolished	yes	125–175 sq.ft. 12–16 sq.m.
Slate	Unpolished	yes	125–200 sq.ft. 12–19 sq.m.
May have limited effectiveness on highly porous surfaces. Always test to ensure desired results. Coverage estimates depend on surface texture and porosity.			

Product Data Sheet Enviro Klean® EK Restoration Cleaner

APPLICATION

Read “Preparation” and the Safety Data Sheet before use.

ALWAYS TEST a small area of each surface to confirm suitability, coverage rate and desired results before beginning overall application. Test with the same equipment, recommended surface preparation and application procedures planned for general application. Let surface dry thoroughly before inspection.

Dilution & Mixing

Apply as packaged. Do not alter or dilute.

Stir or mix well before use.

Pretreatment

Pretreating severely stained areas such as horizontal surfaces, and under window sills and eaves with Sure Klean® 766 Limestone & Masonry Prewash may improve results. Read and follow product procedures and recommendations. Pressure rinse, then “afterwash” with EK Restoration Cleaner followed by water rinse. Consult a PROSOCO Customer Care representative or sales manager on pretreatment of severely stained areas.

Application Instructions

1. Working from the bottom to the top, prewet surface with fresh water.
2. Apply cleaner using a brush or roller. Gentle scrubbing application will improve results. Applying with high pressure spray will drive the chemicals deep into the surface, making it difficult to rinse completely. Surface discoloration may result.
3. Leave the cleaning solution on the surface for 10–20 minutes. Heavy soiling or mineral deposits may require longer dwell times. Gently scrub heavily soiled areas. Do not let cleaning solution “dry in” to the masonry. If drying occurs, lightly wet treated surfaces with fresh water, and reapply the cleaner, gently scrubbing.
4. Working from the bottom to the top, rinse thoroughly with fresh water.
5. Repeat steps 1–4 if necessary.

Cleanup

Clean tools and equipment using fresh water.

Maintenance

“Breathable” water repellents reduce absorption of stain-producing elements, keeping surfaces cleaner longer and making future cleaning faster and easier. For more information about water repellents for masonry, contact PROSOCO Customer Care at 800-255-4255 about Sure Klean® Weather Seal products.

WARRANTY

The information and recommendations made are based on our own research and the research of others, and are believed to be accurate. However, no guarantee of their accuracy is made because we cannot cover every possible application of our products, nor anticipate every variation encountered in masonry surfaces, job conditions and methods used. The purchasers shall make their own tests to determine the suitability of such products for a particular purpose.

BEST PRACTICES

Inspect glazed terra cotta and tile carefully. Where glaze has partially weathered away or previously etched, cleaning may take off more glaze.

Always test a minimum 4-ft x 4-ft area for compatibility before overall cleaning. Test each type of surface and each type of stain. Also test pressure-rinsing on older masonry. Let test panels dry three to seven days before inspection.

Pretreating severely stained areas such as horizontal surfaces, and under window sills and eaves with Sure Klean® 766 Limestone & Masonry Prewash may improve results.

Do not let cleaning solution “dry in” to the masonry. If drying occurs, lightly wet treated surfaces with fresh water, and reapply the cleaner, gently scrubbing.

Masonry-washing equipment generating 400–1000 psi with a water flow rate of 6–8 gpm is the best water/pressure combination for rinsing porous masonry. Use a 15–45° fan spray tip. Heated water (150–180°F; 65–82°C) may improve cleaning efficiency. Use adjustable equipment for reducing water flow rates and rinsing pressure as needed for sensitive surfaces.

Never go it alone. If you have problems or questions, contact your local PROSOCO distributor or field representative. Or call PROSOCO technical Customer Care, toll-free, at 800-255-4255.

Product Data Sheet Enviro Klean® EK Restoration Cleaner

PROSOCO, Inc. warrants this product to be free from defects. **Where permitted by law, PROSOCO makes no other warranties with respect to this product, express or implied, including without limitation the implied warranties of merchantability or fitness for particular purpose.**

The purchaser shall be responsible to make his own tests to determine the suitability of this product for his particular purpose. PROSOCO's liability shall be limited in all events to supplying sufficient product to re-treat the specific areas to which defective product has been applied. Acceptance and use of this product absolves PROSOCO from any other liability, from whatever source, including liability for incidental, consequential or resultant damages whether due to breach of warranty, negligence or strict liability. This warranty may not be modified or extended by representatives of PROSOCO, its distributors or dealers.

CUSTOMER CARE

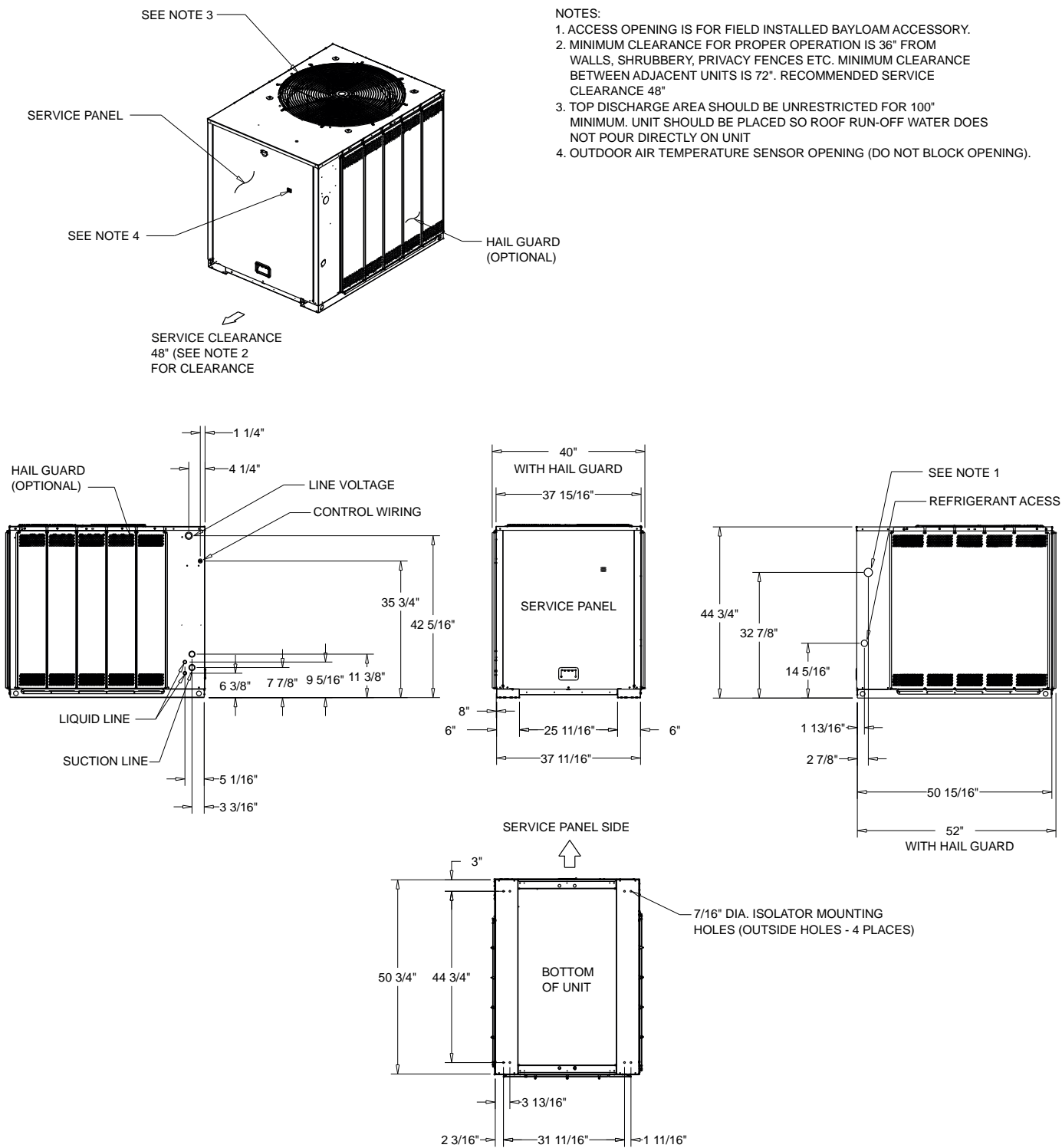
Factory personnel are available for product, environment and job-safety assistance with no obligation. Call 800-255-4255 and ask for Customer Care – technical support.

Factory-trained representatives are established in principal cities throughout the continental United States. Call Customer Care at 800-255-4255, or visit our web site at www.prosoco.com, for the name of the PROSOCO representative in your area.



Unit Dimensions - Split System Air Conditioning Units (Large)

Item: A2 Qty: 2 Tag(s): CU-2&3



12 1/2 TON COOLING CONDENSER (DUAL COMPRESSOR)
DIMENSIONAL DRAWING

BASCO
607 Shelby St.
Suite 400
Detroit, MI. 48226

SHEET #	SHEET NAME	SHEET CATAGORY
C-001	PROJECT COVER	
C-010	CIVIL COVER	CIVIL
C-110	EXISTING CONDITIONS	CIVIL
C-200	DEMOLITION PLAN	CIVIL
C-300	SESC PLAN	CIVIL
C-400	GEOMETRIV PAVING PLAN	CIVIL
C-500	GRADING PLAN	CIVIL
C-600	UTILITY PLAN	CIVIL
	DETAILS	CIVIL
S1-0	GENERAL NOTES	STRUCTURAL
S1-1	DETAILS	STRUCTURAL
S2-1	GROUND FLOOR FRAMING PLAN	STRUCTURAL
S2-2	2ND-5TH FLOOR FRAMING PLAN	STRUCTURAL
S2-3	ROOF FRAMING PLAN	STRUCTURAL
S2-4	HIGH ROOF FRAMING PLAN	STRUCTURAL
S3-1	DETAILS	STRUCTURAL
A-000	LIFE SAFETY PLAN	ARCHITECTURAL
A-001	GENERAL NOTES	ARCHITECTURAL
A-002	SCHEDULES	ARCHITECTURAL
A-101	SITE PLAN	ARCHITECTURAL
A-102	ENLARGED ALLEY PLAN	ARCHITECTURAL
D-101	GROUND, 2ND FL. DEMOLITION PLANS	ARCHITECTURAL
D-102	3RD, 24TH FL. DEMOLITION PLANS	ARCHITECTURAL
D-103	5TH FL. DEMOLITION PLAN	ARCHITECTURAL
A-201	GROUND FLOOR PLAN/ REFLECTED CEILING PLAN	ARCHITECTURAL
A-202	2ND FLOOR PLAN/ REFLECTED CEILING PLAN	ARCHITECTURAL
A-203	3RD FLOOR PLAN/ REFLECTED CEILING PLAN	ARCHITECTURAL
A-204	4TH FLOOR PLAN/ REFLECTED CEILING PLAN	ARCHITECTURAL
A-205	5TH FLOOR PLAN/ REFLECTED CEILING PLAN	ARCHITECTURAL
A-206	ROOF PLAN	ARCHITECTURAL
A-207-208	NOT USED	ARCHITECTURAL
A-209	ENLARGED TOILET ROOM PLANS	ARCHITECTURAL
A-210	ENLARGED LOBBY	ARCHITECTURAL
A-301	SOUTH AND WEST ELEVATIONS	ARCHITECTURAL
A-302	NORTH AND EAST ELEVATIONS	ARCHITECTURAL
A-401	SECTIONS	ARCHITECTURAL
A-403	ENLARGED ELEVATIONS	ARCHITECTURAL
A-405	ENLARGED ALLEY SECTION	ARCHITECTURAL
A-501	SHAFT DETAILS	ARCHITECTURAL
A-502-799	NOT USED	ARCHITECTURAL
A-800	TYP. WALL TYPES	ARCHITECTURAL
A-801	NOT USED	ARCHITECTURAL
A-802	DOOR DETAILS	ARCHITECTURAL
A-803-807	NOT USED	ACRHITECTURAL
A-808	STOREFRONT DETAILS	ARCHITECTURAL
A-809	WINDOW DETAILS	ARCHITECTURAL
A-810	MISCELLANEOUS DETAILS	ARCHITECTURAL
A-811	EXTERIOR OPENING DETAILS	ARCHITECTURAL
P-101	1ST FLOOR UNDERGROUND PLUMBING	PLUMBING
P-102	1ST FLOOR PLUMBING PLAN	PLUMBING
P-103	2ND FLOOR PLUMBING PLAN	PLUMBING
P-104	3RD FLOOR PLUMBING PLAN	PLUMBING
P-105	4TH FLOOR PLUMBING PLAN	PLUMBING
P-106	5TH FLOOR PLUMBING PLAN	PLUMBING
P-107	ROOF PLUMBING PLAN	PLUMBING
P-108	TOILET ROOM CORE PLUMBING PLAN	PLUMBING
P-201	SCHEDULES AND SPECIFICATIONS	PLUMBING
M-101	1ST FLOOR HVAC PLAN	MECHANICAL
M-102	2ND FLOOR HVAC PLAN	MECHANICAL
M-103	3RD FLOOR HVAC PLAN	MECHANICAL
M-104	4TH FLOOR HVAC PLAN	MECHANICAL
M-105	5TH FLOOR HVAC PLAN	MECHANICAL
M-106	ROOF HVAC PLAN	MECHANICAL
M-201	HVAC DETAILS	MECHANICAL
M-202	HVAC SCHEDULES	MECHANICAL
M-203	HVAC SPECIFICATIONS	MECHANICAL
E-1	GROUND FLOOR ELECTRICAL	ELECTRICAL
E-2	2ND FLOOR ELECTRICAL	ELECTRICAL
E-3	3RD FLOOR ELECTRICAL	ELECTRICAL
E-4	4TH FLOOR ELECTRICAL	ELECTRICAL
E-5	5TH FLOOR ELECTRICAL	ELECTRICAL
E-6	ROOF ELECTRICAL	ELECTRICAL
E-7	ELECTRICAL SPECIFICATIONS	ELECTRICAL
E-8	ELECTRICAL SPECIFICATIONS	ELECTRICAL
E-9	ELECTRICAL SCHEDULES	ELECTRICAL
E-9A	ELECTRICAL SCHEDULES	ELECTRICAL
E-10	ENLARGED ALLEY ELECTRICAL	ELECTRICAL

220 W. Congress Remodeling
Issued for REVISION 2

JUNE 12, 2019

ARCHITECT:



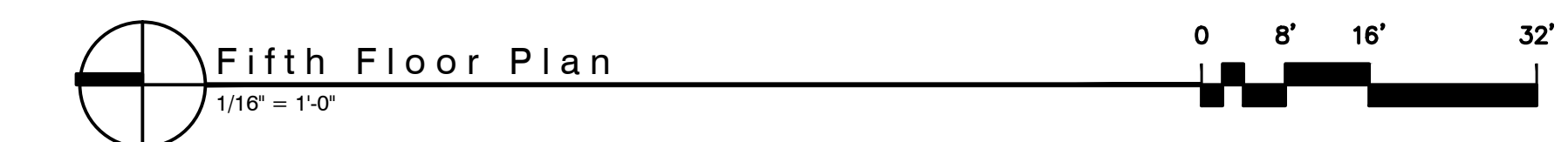
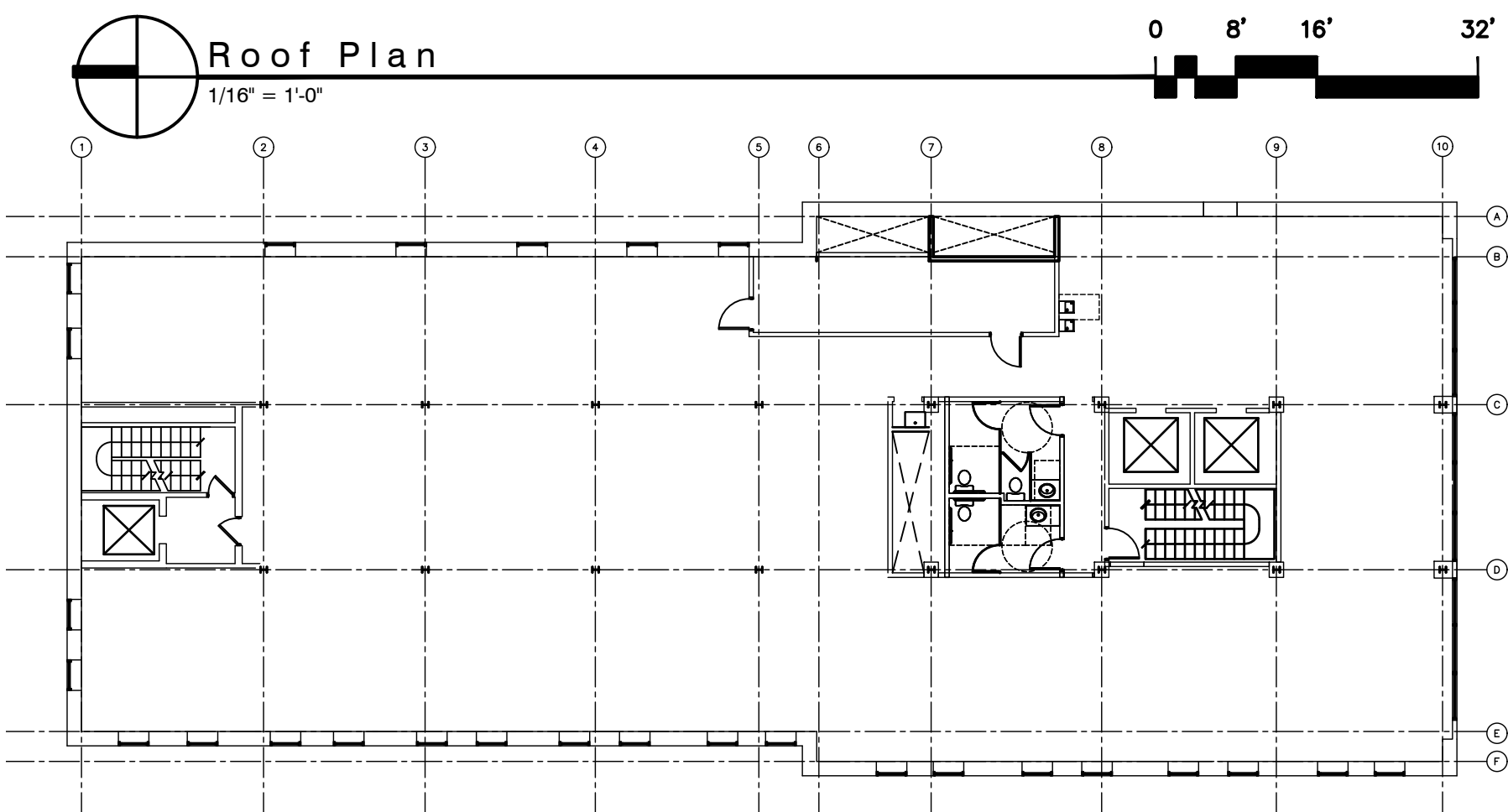
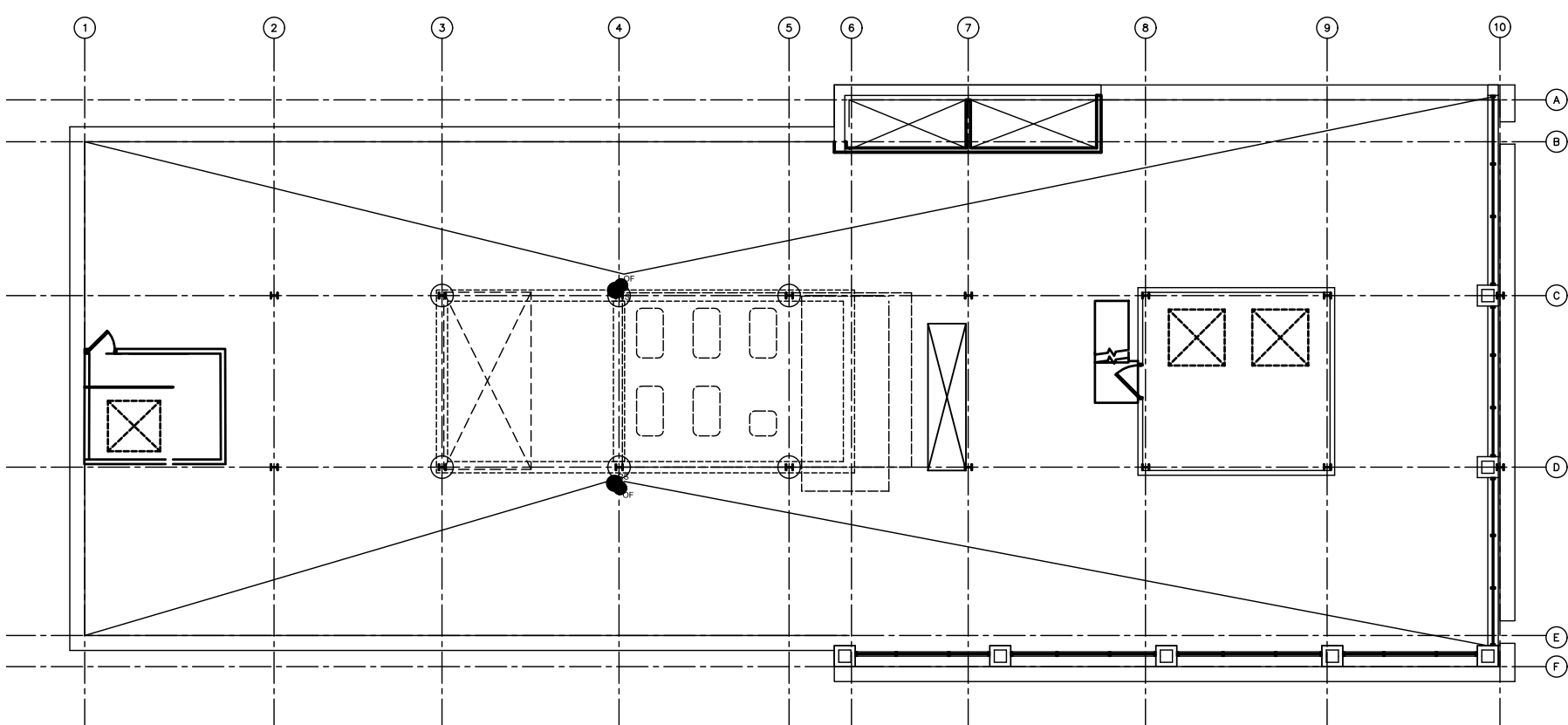
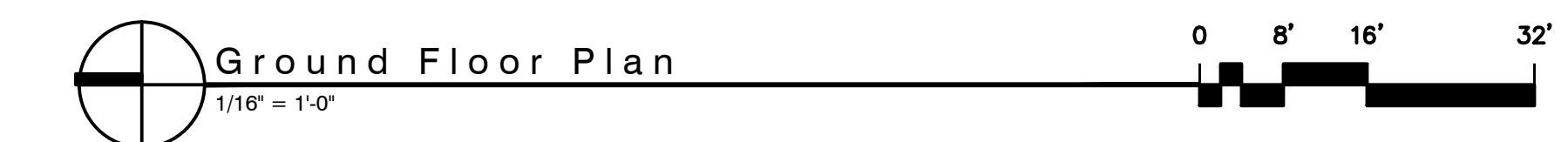
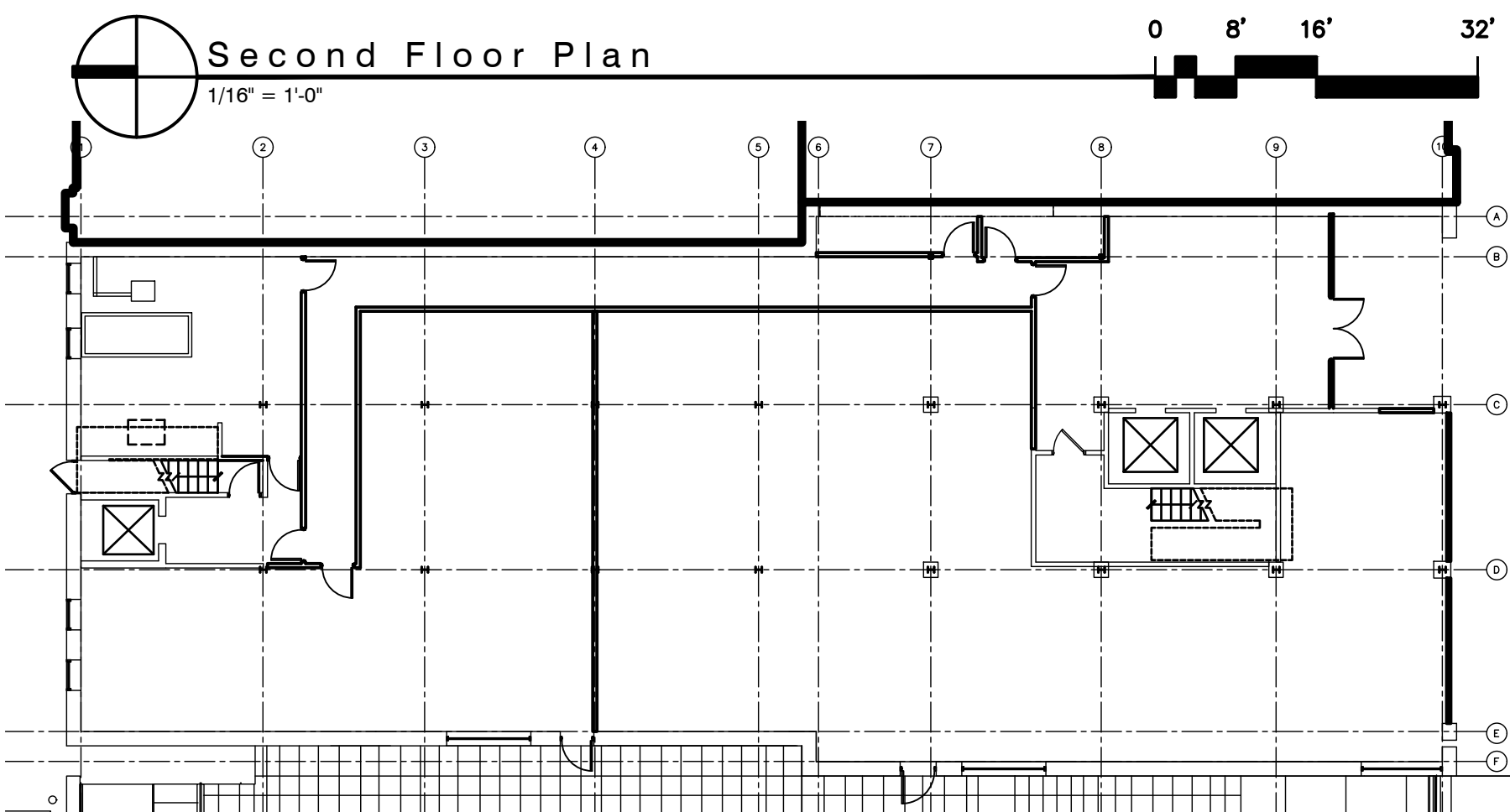
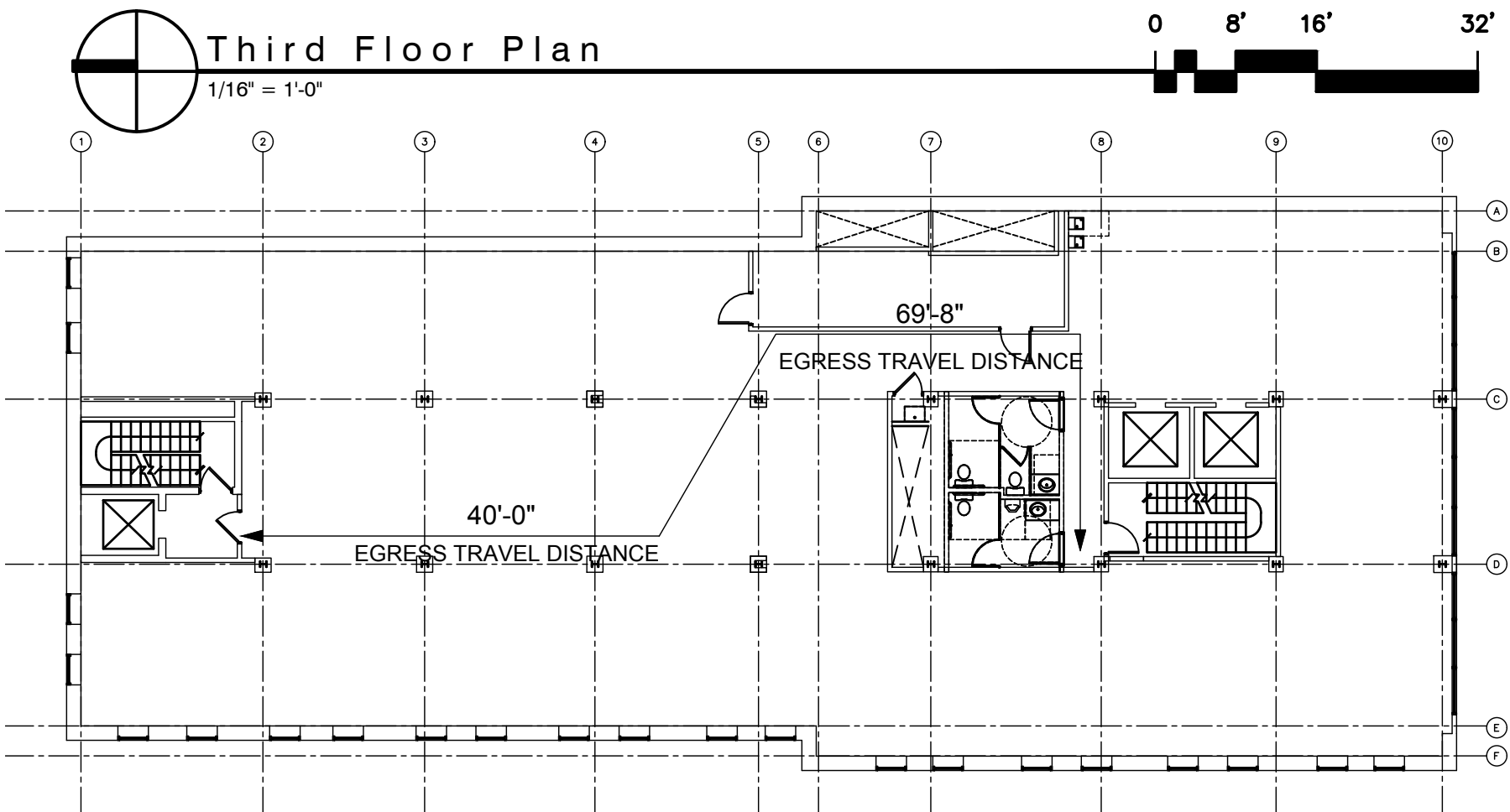
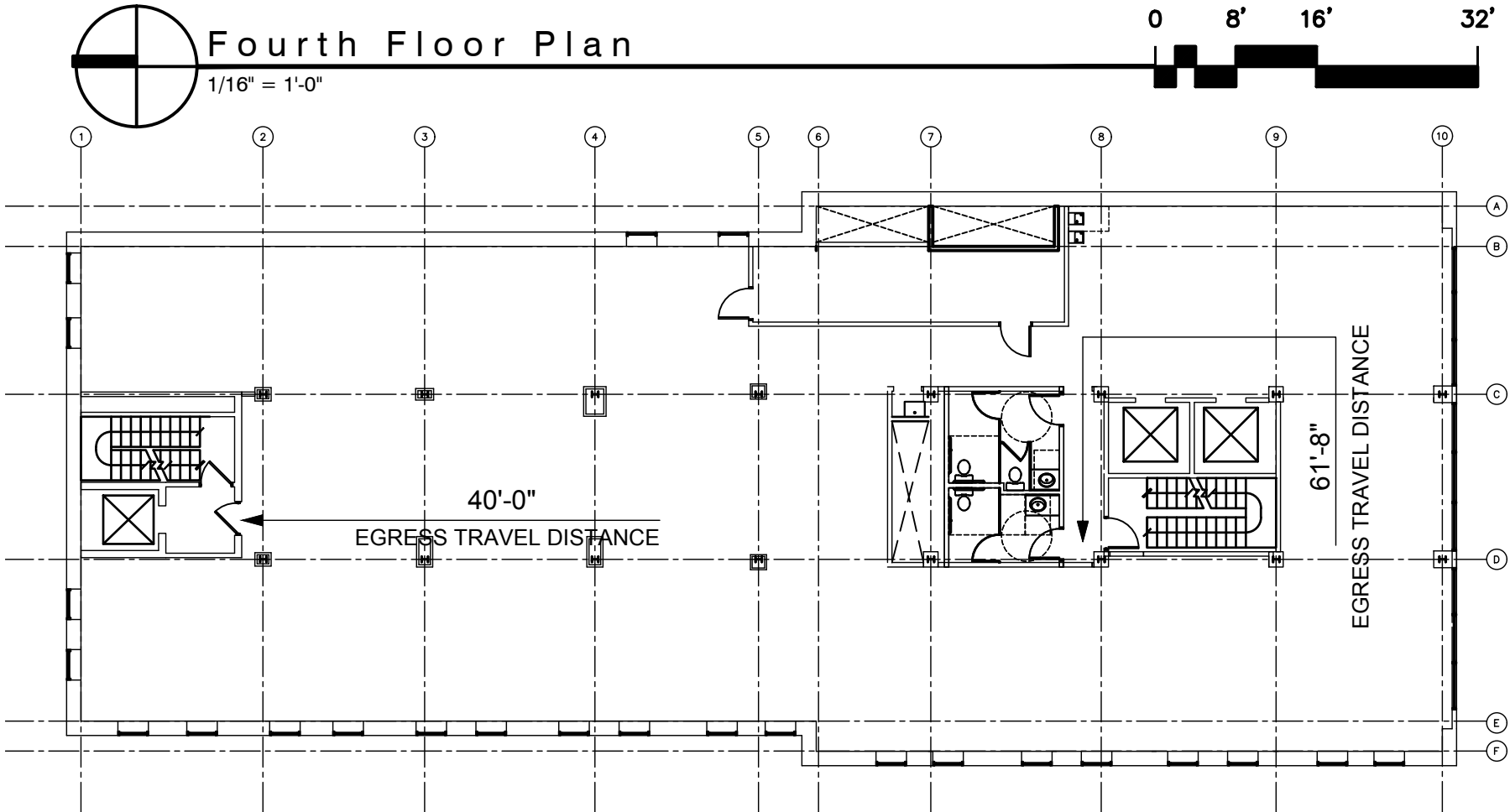
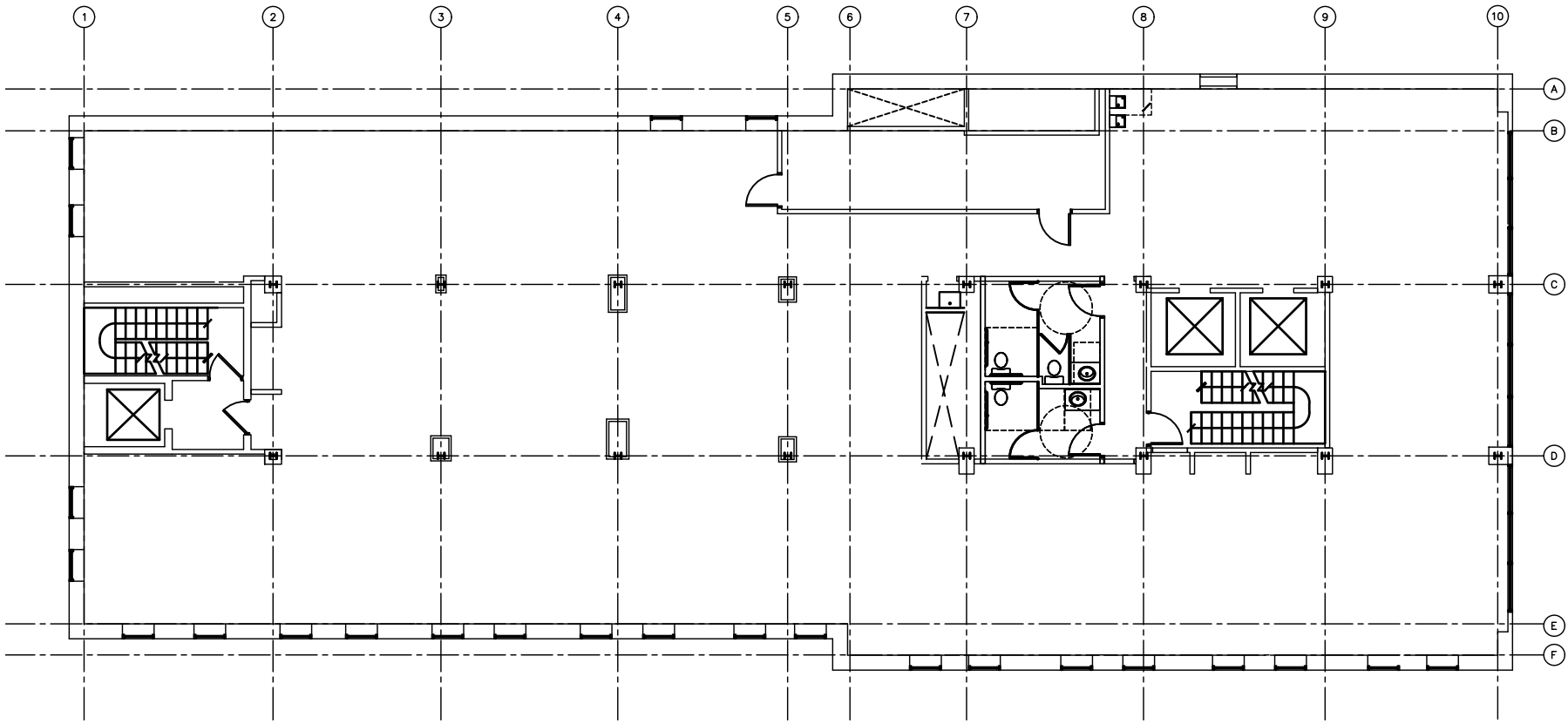
615 Griswold St.
Suite 1710
Detroit, MI. 48226
313.963.6687

MEP ENGINEERS:
Summit Engineering

STRUCTURAL ENGINEERS:
SDI Structures

CIVIL ENGINEERS
Giffels Webster Engineers





PROJECT CONSISTS OF
"WHITE BOX" OFFICE SPACE ABOVE
1 STORY OF "WHITE BOX" RETAIL
SPACE ON THE FIRST FLOOR. PROJECT
INCLUDES PREP FOR FUTURE TENANTS
AND OPTIONAL ROOF DECK FOR THE
FIFTH FLOOR SPACE ONLY. UPGRADES
TO RESTROOM FACILITIES ARE INCLUDED
IN THE "WHITE BOX" BUILDOUT. UPDATED
ELEVATOR CONTROLS AND NEW ROOFTOP
HVAC UNITS ARE ALSO INCLUDED.

K2017-09 220 W Congress Project Summary

1. Summary
2. Architect: Archive DS
3. Address: 220 W. Congress St., Detroit, MI
4. Legal description: N W CONGRESS E 3 FT OF S 65 FT OF 10 11 W 4 FT OF S 65 FT OF 12 MILITARY RESERVE L5 P218 CITY RECORDS, W C R 2/58 57 IRREG
5. Parcel id: 02000162
6. Total Parcel Acreage: 0.169 (7,362sf)
7. Commercial Floor Area: 36,775 sf
8. 7.355sf per floor gross
9. Stories: 5[a]
10. Scope of work:
Interior alteration to existing office building.
Addition to roof of existing building.
11. Zoning
1. Zoning District: Major Business District
2. Building Code
1. Michigan Rehabilitation Code for Existing Buildings 2015 (References MBC 2015)
Michigan Mechanical Code 2015
Michigan Plumbing Code 2015
Michigan Electrical Code 2015
3. CHAPTER 5 - ALTERATIONS-LEVEL 2
1. Chapter 3 Use and Occupancy
1. 304.1 Business Group B
1. Chapter 4
1. SECTION 403 HIGH-RISE BUILDINGS
1. 403.1 Applicability. The provisions of this section shall apply to buildings having the occupied floors located more than 55 feet (16 764 mm) above the lowest level of fire department vehicle access.
4. HIGHEST OCCUPIED FLOOR: 49'-0" (DOES NOT MEET HIGHEST OCCUPANCY CLASSIFICATION)
1. Exception: The provisions of this section shall not apply to the following buildings and structures:
2. 6. Existing buildings having occupied floor levels not more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access where the local unit of government complies with both of the following:
1. 6.1. The local unit of government has a municipal fire department with an ISO rating of 3 or lower, employing a full-time career firefighting staff.
2. 6.2. The governing body of the local unit of government has passed a resolution affirming the use of this exception and filed that resolution with the department of energy, labor, and economic growth, bureau of construction codes.
5. CHAPTER 5 - GENERAL BUILDING HEIGHTS AND AREAS
1. Chapter 6 Construction Type:
2. 602.3 Type IIIB
1. Steel (iron) columns
2. Steel (iron) beams
3. Timber girders
4. Wood floor deck[b]
6. Primary Structural Frame: 0 HR
7. Bearing Walls Exterior: 2 HR
8. Bearing Walls Interior: 0 HR
9. Non-Bearing Walls Exterior: 1 HR
10. Non-Bearing Walls Interior: 1 HR
11. Floor Construction: 0 HR
12. Roof Construction: 0 HR
7. TABLE 508.4 OCCUPANCY SEPARATION
1st Floor Assembly Occupancy. Upper floors Business occupancy: 1HR
1st floor Type 3B construction: 1 Story
2nd-5th floor Type 3B construction: 4 stories (1 story allowable sprinkler increase)
8. BUILDING IS EQUIPPED WITH AN AUTOMATIC SPRINKLER SYSTEM.
1. (d). An approved automatic sprinkler system in accordance with Section 903.3.1.1 shall be allowed to be substituted for 1-hour fire-resistance-rated construction, provided such system is not otherwise required by other provisions of the code or used for an allowable area increase in accordance with Section 506.3 or an allowable height increase in accordance with Section 504.2. The 1-hour substitution for the fire resistance of exterior walls shall not be permitted.
9. Chapter 10 Means of Egress
1. TABLE 1004.1.2 - MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT
1. Assembly without fixed seats
2. Concentrated (chairs only-not fixed) 7 net
3. Standing space 5 net
4. Unconcentrated (tables and chairs) 15 net
5. Business areas 100 gross
6. Mercantile
7. Basement and grade floor areas 30 gross
8. Office 7,355sf / 100sf per occupant = 74 person occupancy per floor for office use
10. SECTION 1016 - EXIT ACCESS TRAVEL DISTANCE
1. c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
1. SECTION 1018-CORRIDORS
1. SECTION 1025 HORIZONTAL EXITS
1. 1025.1 Horizontal exits. Horizontal exits serving as an exit in a means of egress system shall comply with the requirements of this section. A horizontal exit shall not serve as the only exit from a portion of a building, and where two or more exits are required, not more than one-half of the total number of exits or total exit width shall be horizontal exits [a]
2. 1025.2 Separation. The separation between buildings or refuge areas connected by a horizontal exit shall be provided by a fire wall complying with Section 706; or it shall be provided by a fire barrier complying with Section 707 or a horizontal assembly complying with Section 711, or both. The minimum fire-resistance rating of the separation shall be 2 hours.
1. SECTION 1027 EXIT DISCHARGE
1. 1027.1 General. Exits shall discharge directly to the exterior of the building. The exit discharge shall be at grade or shall provide direct access to grade. The exit discharge shall not reenter a building. The combined use of Exceptions 1 and 2 shall not exceed 50 percent of the number and capacity of the required exits.
2. 1. Exceptions:
2. 1. A maximum of 50 percent of the number and capacity of interior exit stairways and ramps is permitted to egress through areas on the level of exit discharge provided all of the following are met:
1. 1.1. Such enclosures egress to a free and unobstructed path of travel to an exterior exit door and such exit is readily visible and identifiable from the point of termination of the enclosure.
1. 3. Horizontal exits complying with Section 1025 shall not be required to discharge directly to the exterior of the building
1. Chapter 11 Accessibility
1. 1103.2.2 Existing buildings. Existing buildings shall comply with Section 3411
2. 1105.1 Public entrances. In addition to accessible entrances required by Sections 1105.1.1 through 1105.1.6, at least 60percent of all public entrances shall be accessible
1. CHAPTER 34 - EXISTING BUILDINGS AND STRUCTURES
1. SECTION 3411 - ACCESSIBILITY FOR EXISTING BUILDINGS
1. 3411.8.1 Entrances. Accessible entrances shall be provided in accordance with Section 1105
2. 3411.8.2 Elevators. Altered elements of existing elevators shall comply with the Michigan elevator code, R 408.700to R 408.8695 and ICC/ANSI A 117.1 as listed in chapter 35. Such elements shall also be altered in elevators programmed to respond to the same hall call control as the altered elev
[c]See SECTION 1027 EXIT DISCHARGE

3. 3411.8.11 Toilet rooms. Where it is technically infeasible to alter existing toilet and bathing rooms to be accessible, an accessible family or assisted-use toilet or bathing room constructed in accordance with Section 1109.2.1 is permitted. The family or assisted-use toilet or bathing room shall be located on the same floor and in the same area as the existing toilet or bathing rooms.
4. 1. Plumbing Code
1. Table 403.1 - #2
1. Water closets 1per 25 for the first 50, 1 per 50 for remainder
1. 2 toilets required per floor for office
1. Lav - 1 per 40 for the first 80, 1 per 80 for remainder
1. 2 lavs required per floor for office
1. Drinking fountain 1per 100
1. 1 drinking fountain require per floor
1. 1 services sink

SECTION 1027 EXIT DISCHARGE

SECTION 1025 HORIZONTAL EXITS

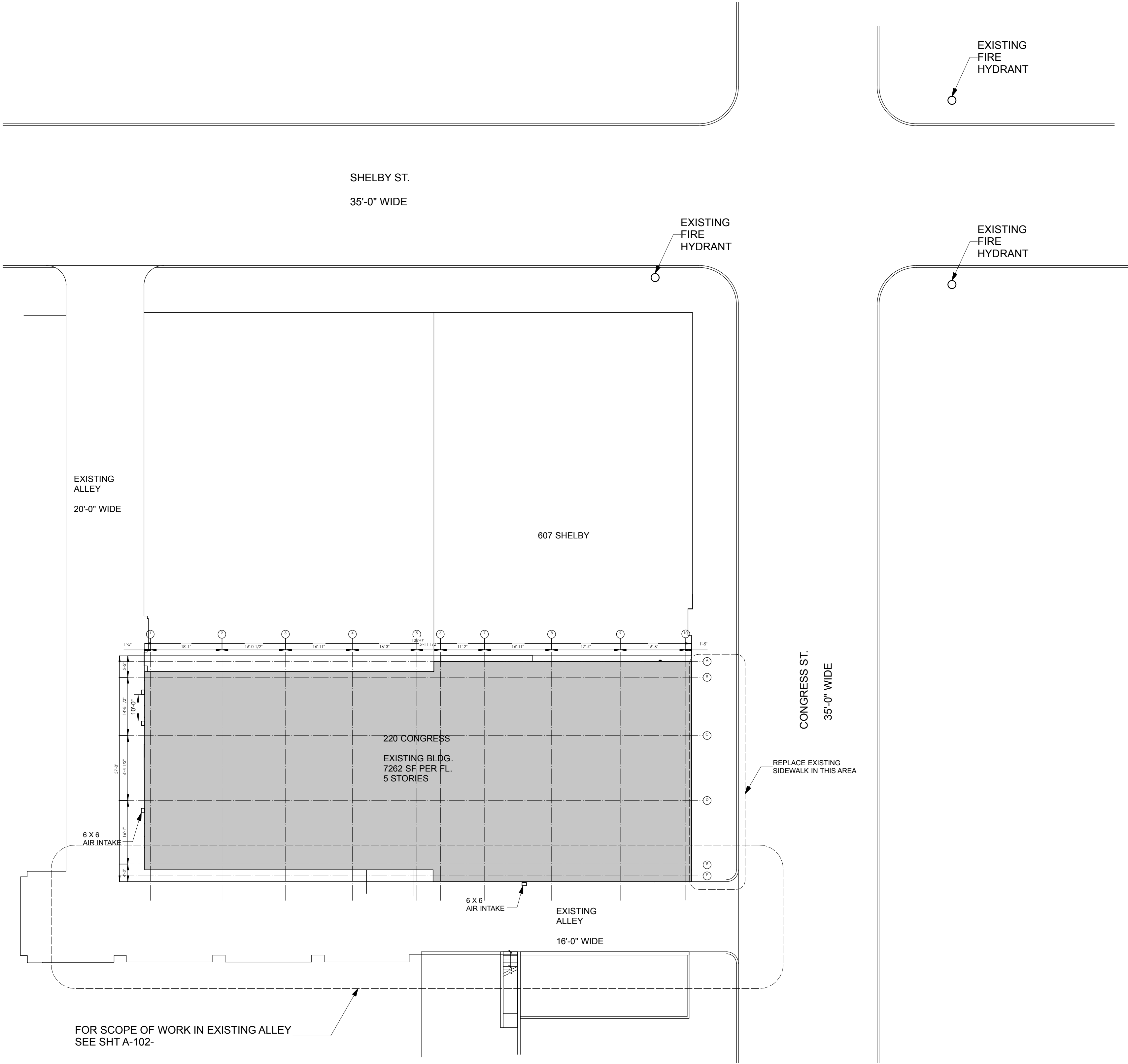
1. 1025.1 Horizontal exits. Horizontal exits serving as an exit in a means of egress system shall comply with the requirements of this section. A horizontal exit shall not serve as the only exit from a portion of a building, and where two or more exits are required, not more than one-half of the total number of exits or total exit width shall be horizontal exits [a]
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3. 3411.8.11 Toilet rooms. Where it is technically infeasible to alter existing toilet and bathing rooms to be accessible, an accessible family or assisted-use toilet or bathing room constructed in accordance with Section 1109.2.1 is permitted. The family or assisted-use toilet or bathing room shall be located on the same floor and in the same area as the existing toilet or bathing rooms.

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220 W. Congress St., Detroit, MI
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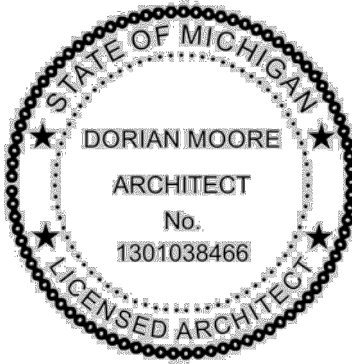
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Life Safety Plan

Issued For:	
Interim Des. Dev.	091417
Des. Dev.	101917
70% CD	030118
Bids	062518
Coordination	012819
Bulletin #1	030119
Bulletin #2	030119
Revisions	050219
Revision 2	6.12.19

Checked:
Approved:
Project Number:
Date: 6 May 2017



SITE PLAN
SCALE: 1/16"=1'-0"



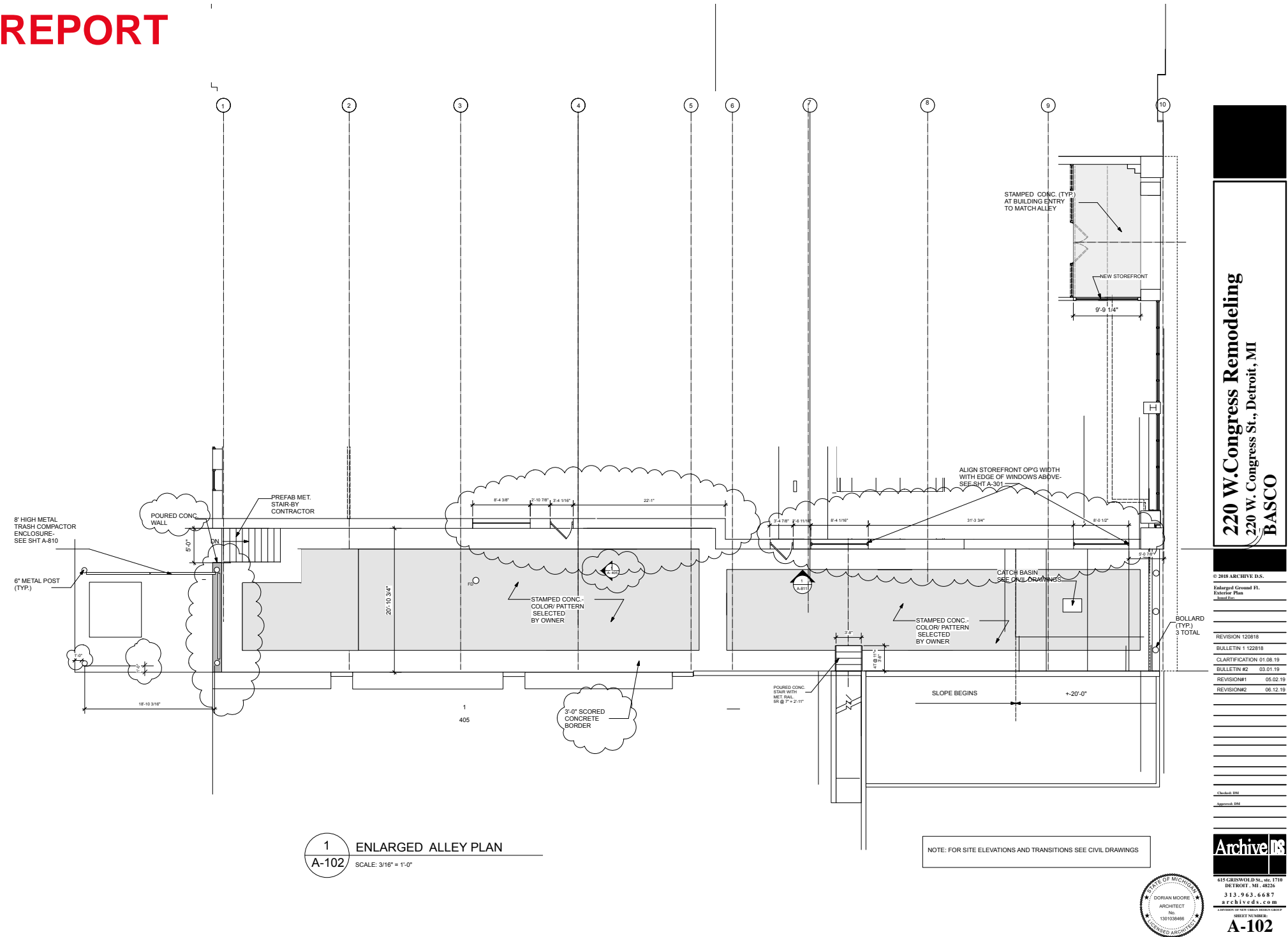
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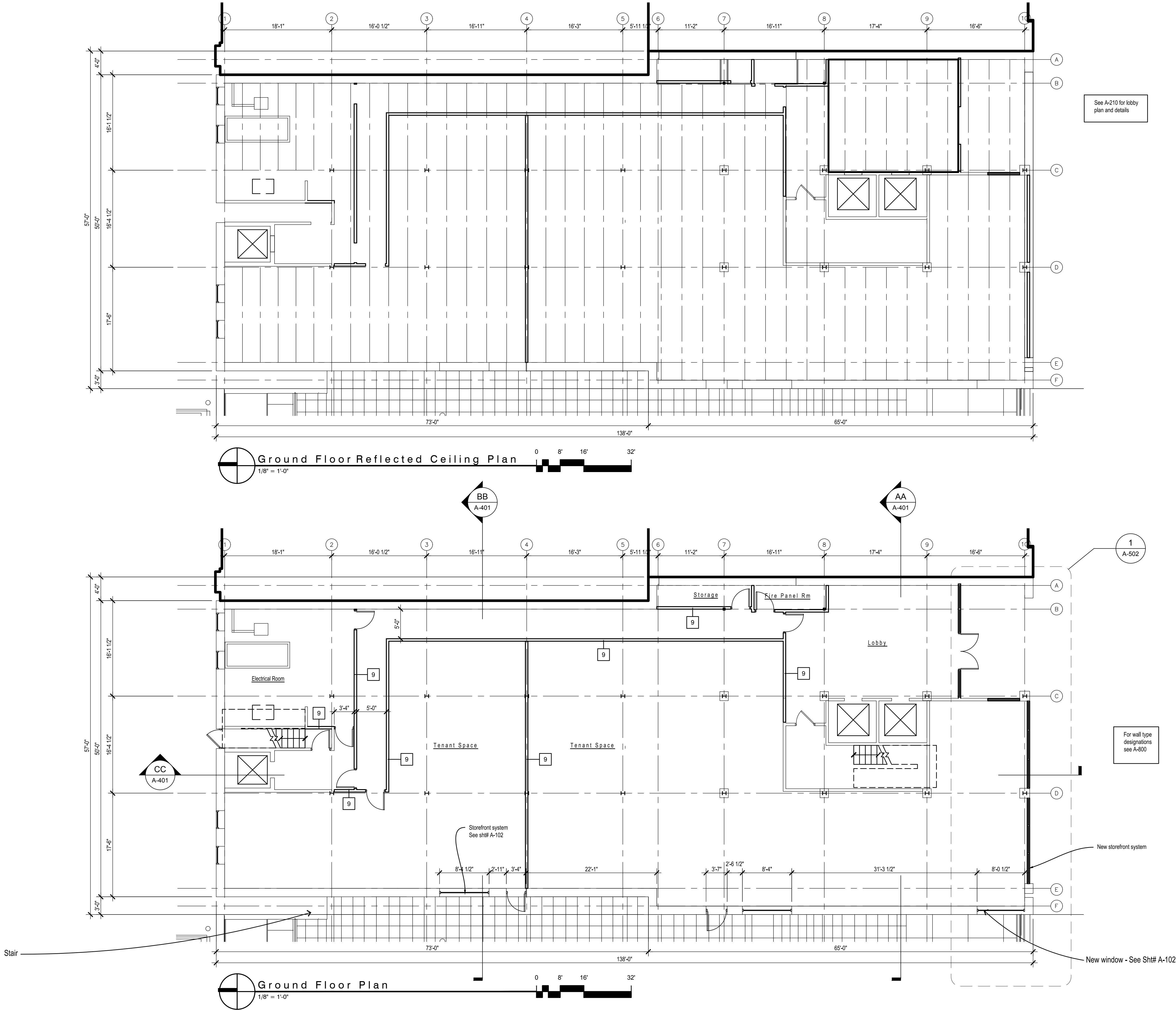
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SITE PLAN	
Issued For:	
REVIEW	
DES. DEVELOPMENT 11.20.17	
CD REVIEW 03.28.18	
REVIEW	05.24.18
BIDS	06.25.18
PERMITS	08.17.18
BULLETIN 1	12.28.18
CLARIFICATION	3.07.19
REVISION #1	05.02.19
REVISION #2	06.12.19

Drawn: KC
Checked: DM
Approved:DM

REPORT

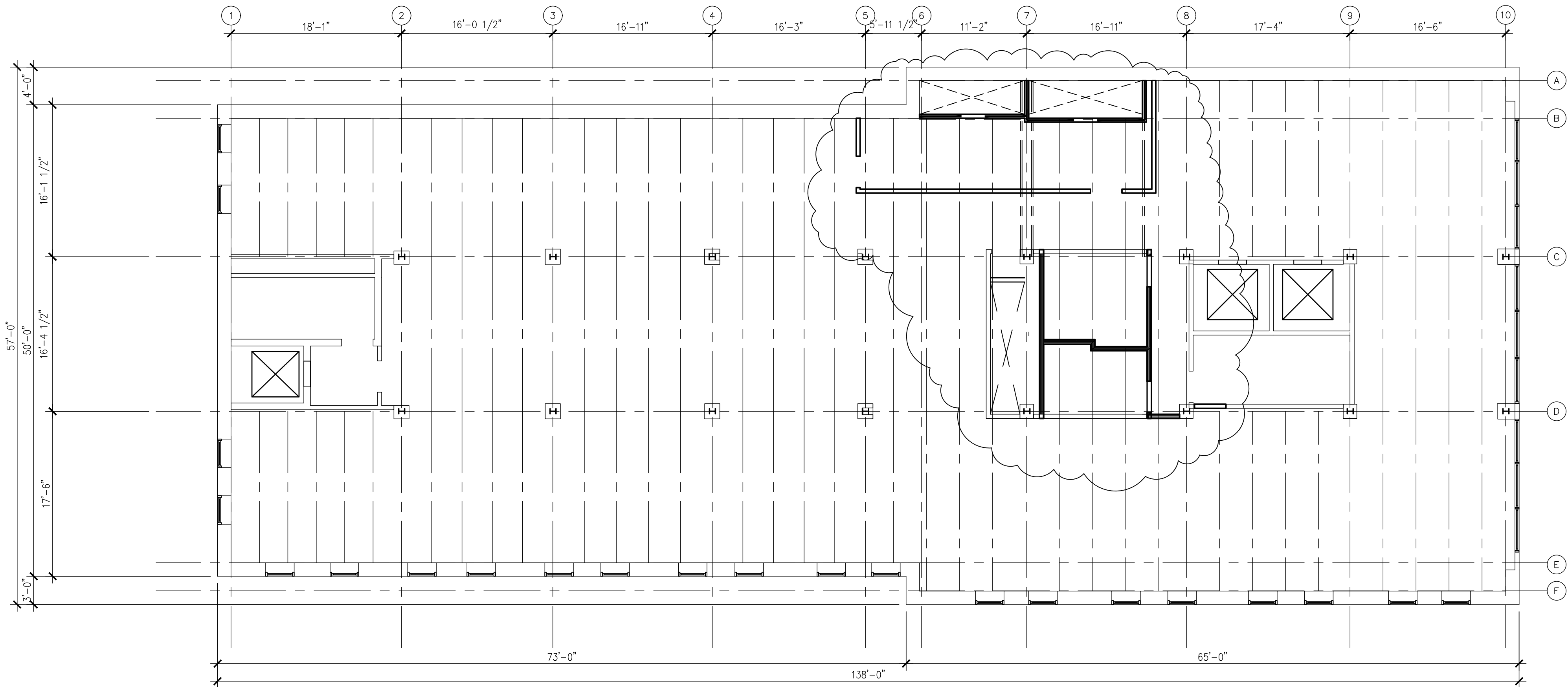




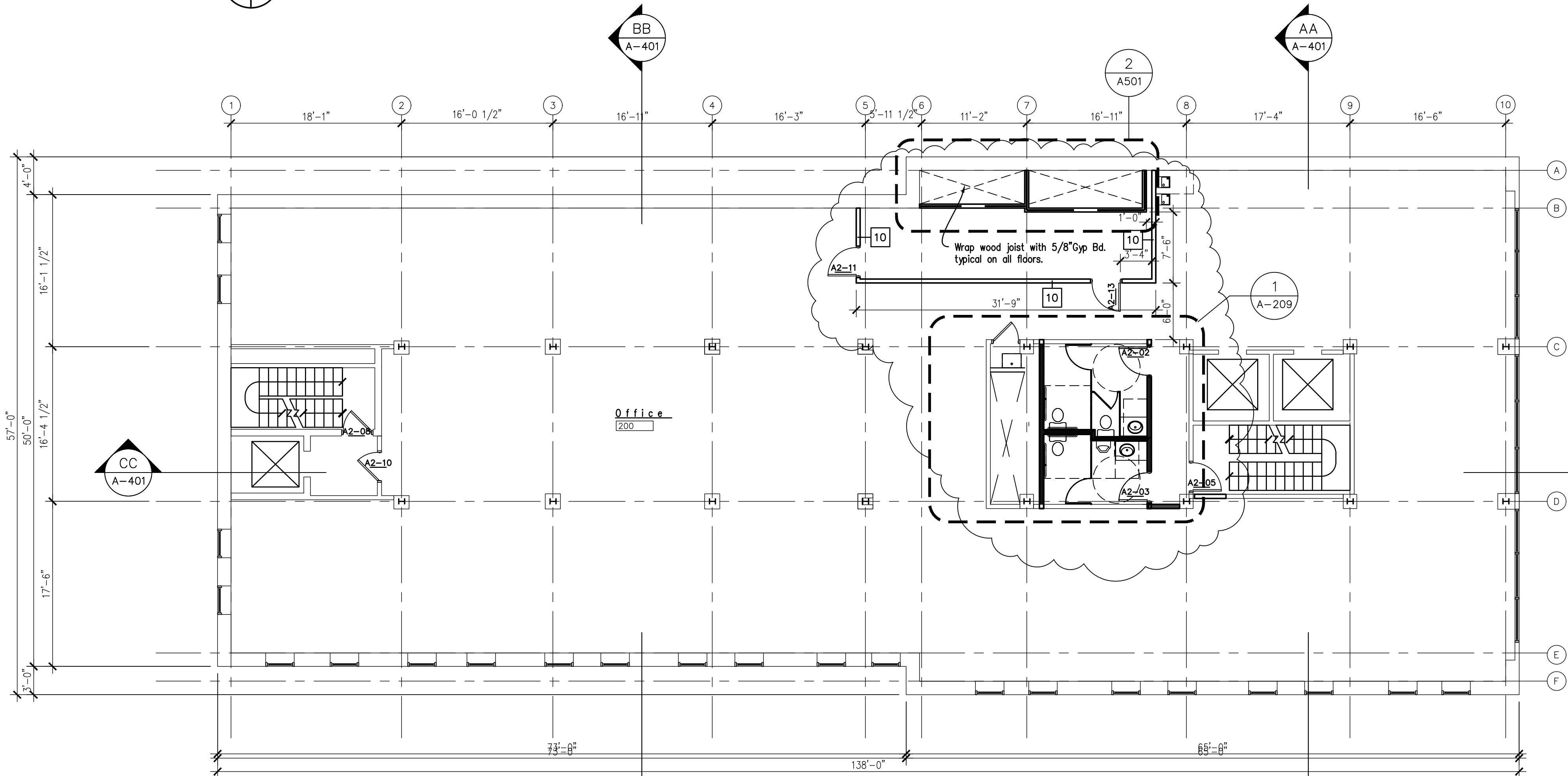
Floor Plan General Notes:
1. Existing electrical receptacles to remain unless noted otherwise.
2. Patch and repair holes and damage to gypsum board partitions.
3. Remove existing floor finish in area of renovation prepare floor for new floor finish.
4. Replace all missing door hardware

Ceiling Notes:
1. Patch and repair damaged areas of existing gyp bd ceiling
2.

- Keynotes:**
1. New shaft mechanical duct work.
 2. Patch and repair damaged subfloor
 3. Gyp bd column enclosure
 4. Patch damaged plaster, Mathe existing adjacent finish.
 5. New aluminium window and frame
 6. New handrail on existing stair.
 7. New light fixture see lighting plan for type.
 8. New stair enclosure
 9. New stair



Second Floor Reflected Ceiling Plan
1/8" = 1'-0"



Second Floor Plan
1/8" = 1'-0"

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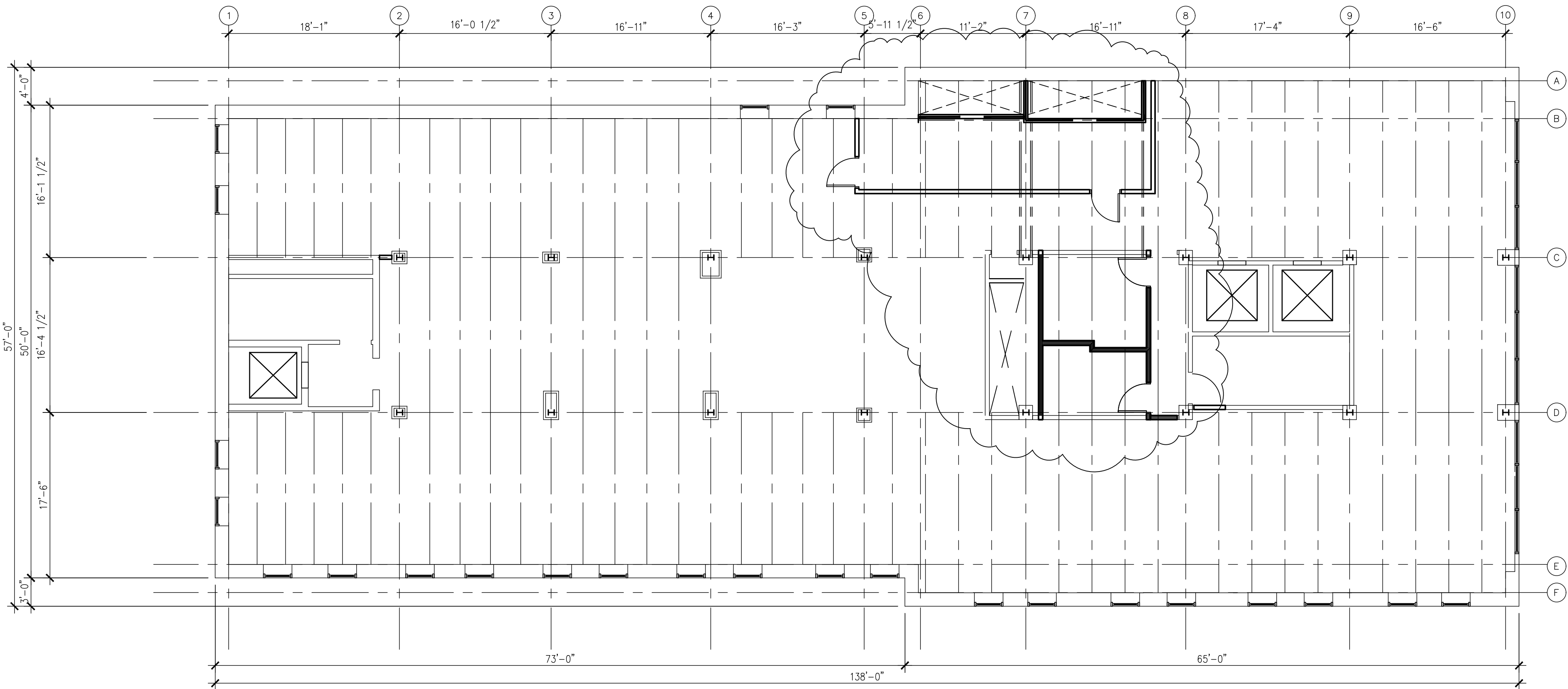
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Second Floor Plan

Issued For:	
Interim Des. Dev.	091417
Des. Dev.	101917
70% CD	030118
Bids	062518
Coordination	012819
Bulletin #1	
Bulletin #2	030119
Revisions	050219
Revision 2	6.12.19

Checked: _____
Approved: _____
Project Number: _____
Date: **May 2019**

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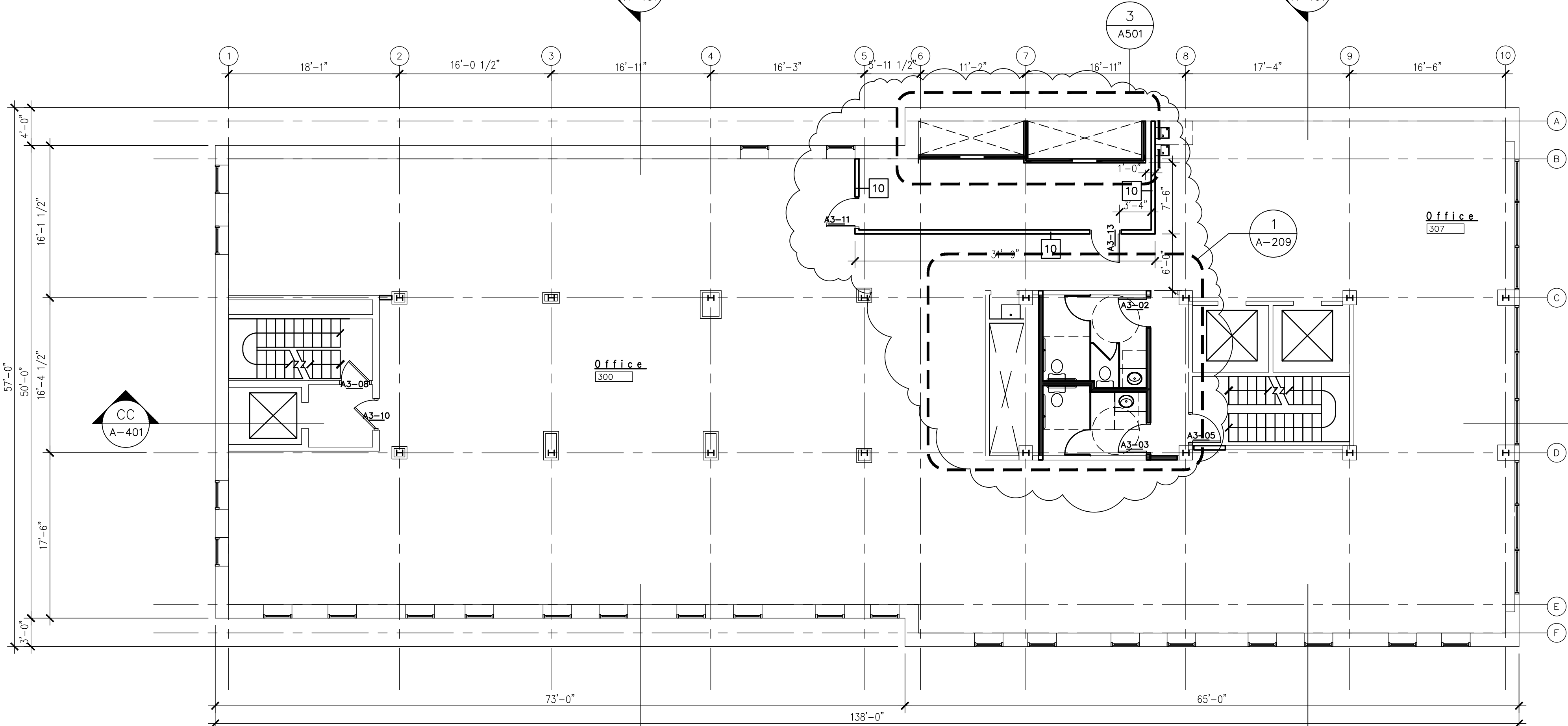




Third Floor Reflected Ceiling Plan

1/8" = 1'-0"

0 8' 16' 32'



Third Floor Plan

1/8" = 1'-0"

0 8' 16' 32'

- Floor Plan General Notes:**
- Existing electrical receptacles to remain unless noted otherwise.
 - Patch and repair holes and damage to gypsum board partitions.
 - Remove existing floor finish in area of renovation prepare floor for new floor finish.
 - Replace all missing door hardware
- Ceiling Notes:**
- Patch and repair damaged areas of existing gyp bd ceiling
 -

- Keynotes:**
- New shaft mechanical duct work.
 - Patch and repair damaged subfloor
 - Gyp bd column enclosure
 - Patch damaged plaster. Match existing adjacent finish.
 - New aluminium window and frame
 - New handrail on existing stair.
 - New light fixture see lighting plan for type.
 - New stair enclosure
 - New stair

For wall
type
designations

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Third Floor Plan

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Bulletin #1	
Bulletin #2	030119
Revisions	050219
Revision 2	6.12.19

Checked:
Approved:
Project Number:
Date:



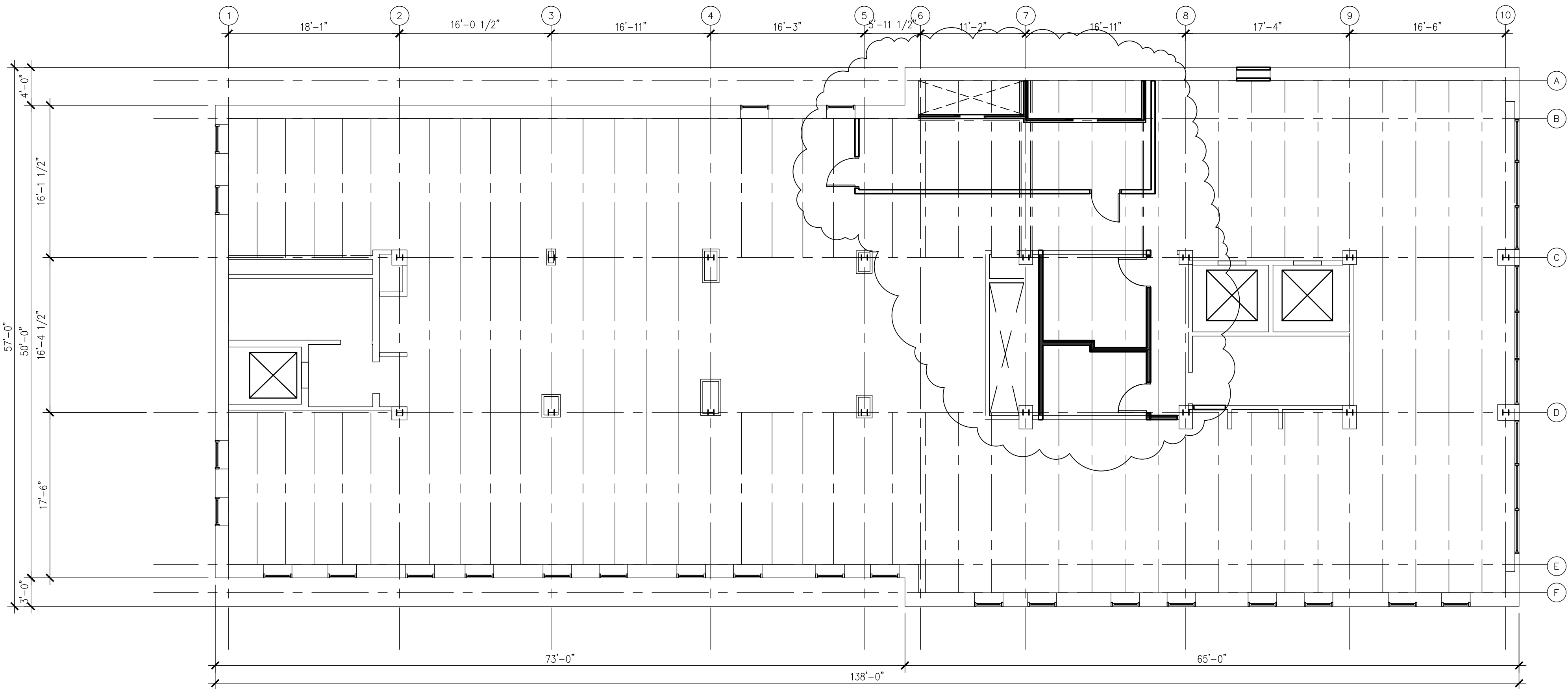
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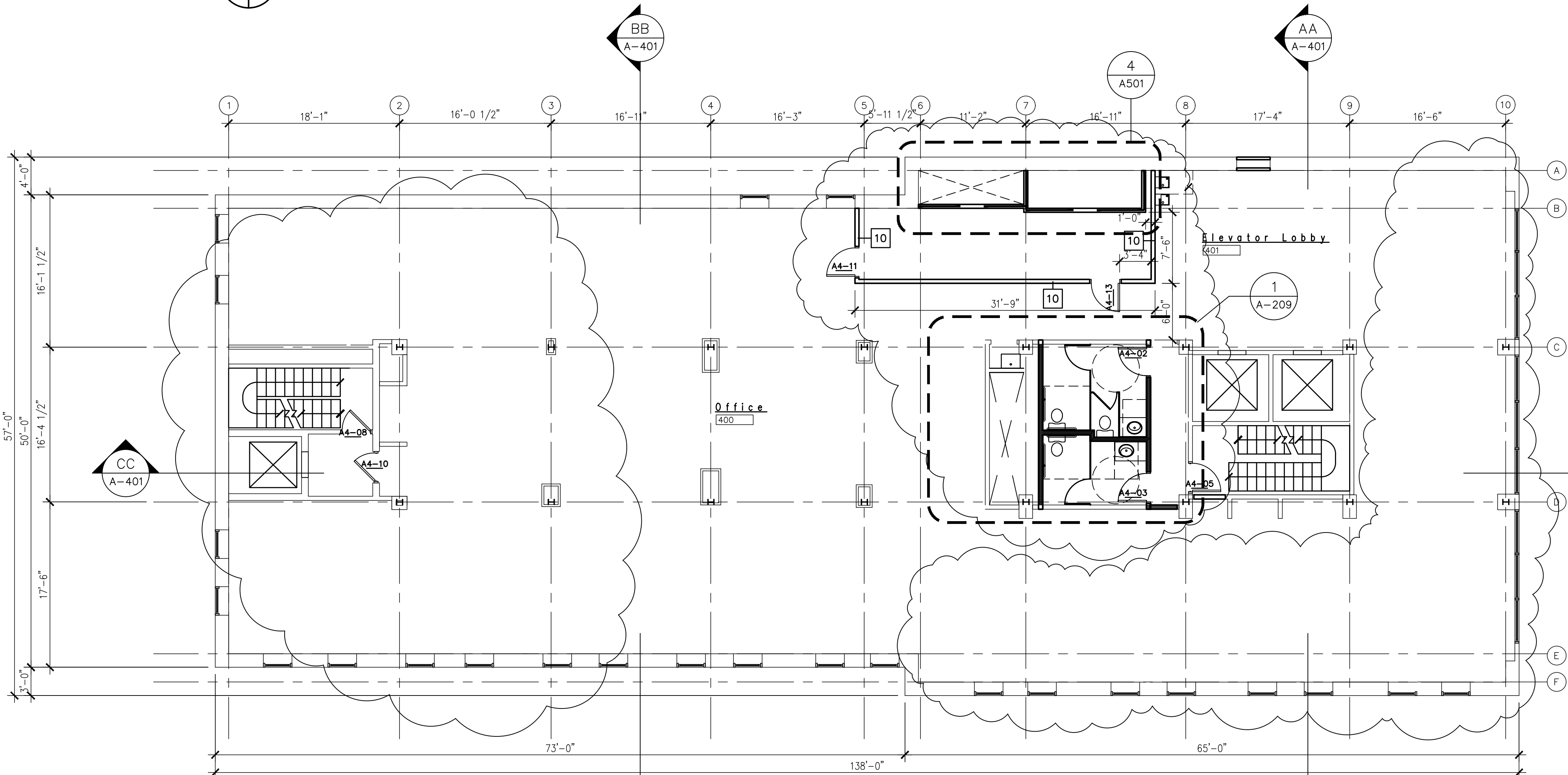
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A-203



Fourth Floor Reflected Ceiling Plan
1/8" = 1'-0"



Fourth Floor Plan
1/8" = 1'-0"

- Floor Plan General Notes:**
1. Existing electrical receptacles to remain unless noted otherwise.
 2. Patch and repair holes and damage to gypsum board partitions.
 3. Remove existing floor finish in area of renovation prepare floor for new floor finish.
 4. Replace all missing door hardware

- Ceiling Notes:**
1. Patch and repair damaged areas of existing gyp bd ceiling
 - 2.

- Keynotes:**
1. New shaft mechanical duct work.
 2. Patch and repair damaged subfloor
 3. Gyp bd column enclosure
 4. Patch damaged plaster, Match existing adjacent finish.
 5. New aluminium window and frame
 6. New handrail on existing stair.
 7. New light fixture see lighting plan for type.
 8. New stair enclosure
 9. New stair

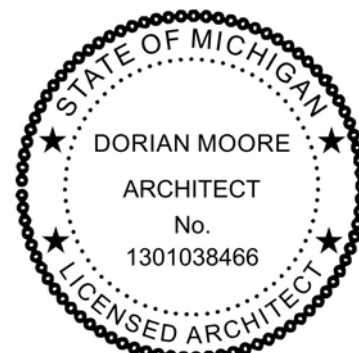
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Fourth Floor Plan

Issued For:	
Interim Des. Dev.	091417
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70% CD	030118
Bids	062518
Coordination	012819
Bulletin #1	
Bulletin #2	030119
Revisions	050219
Revision 2	6.12.19

Checked: _____
Approved: _____
Project Number: _____
Date: **May 2019**

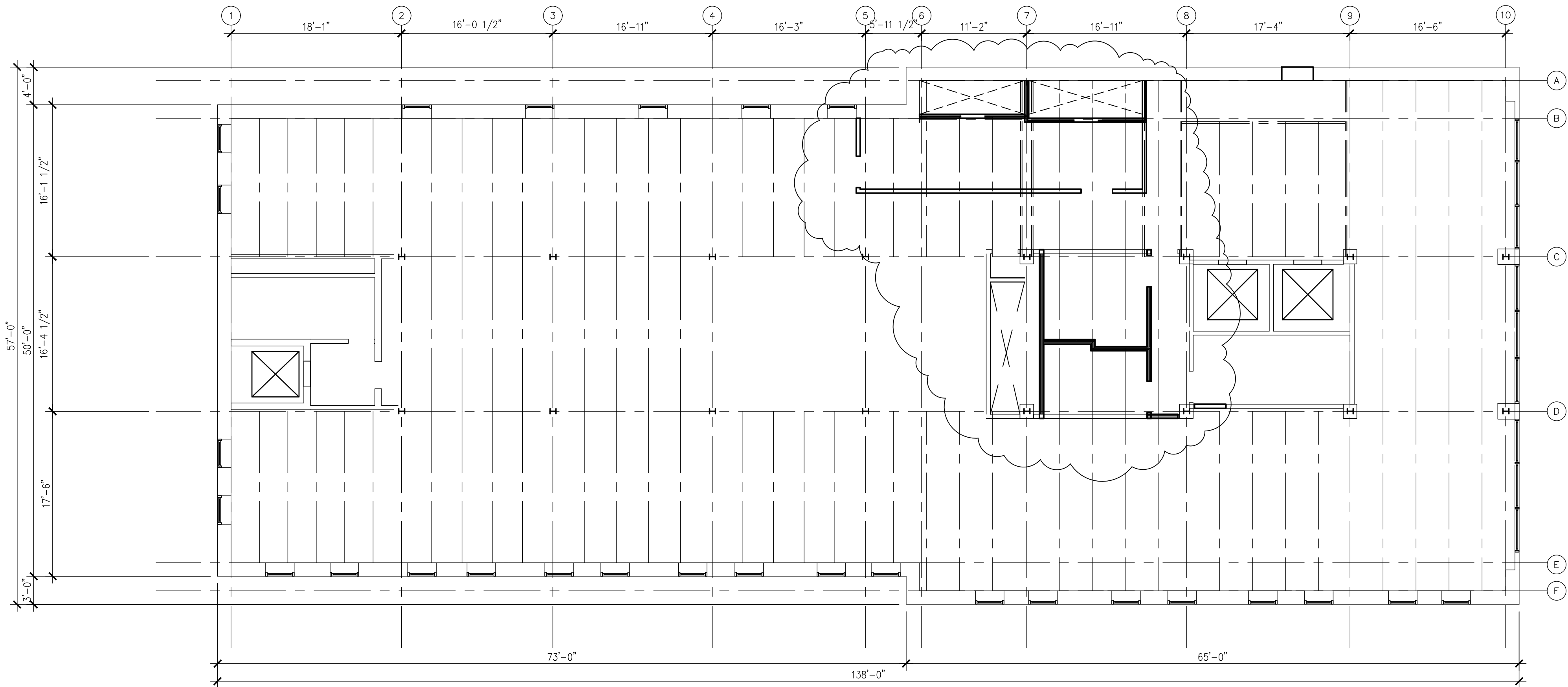
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SHEET MEMBER:
A-204



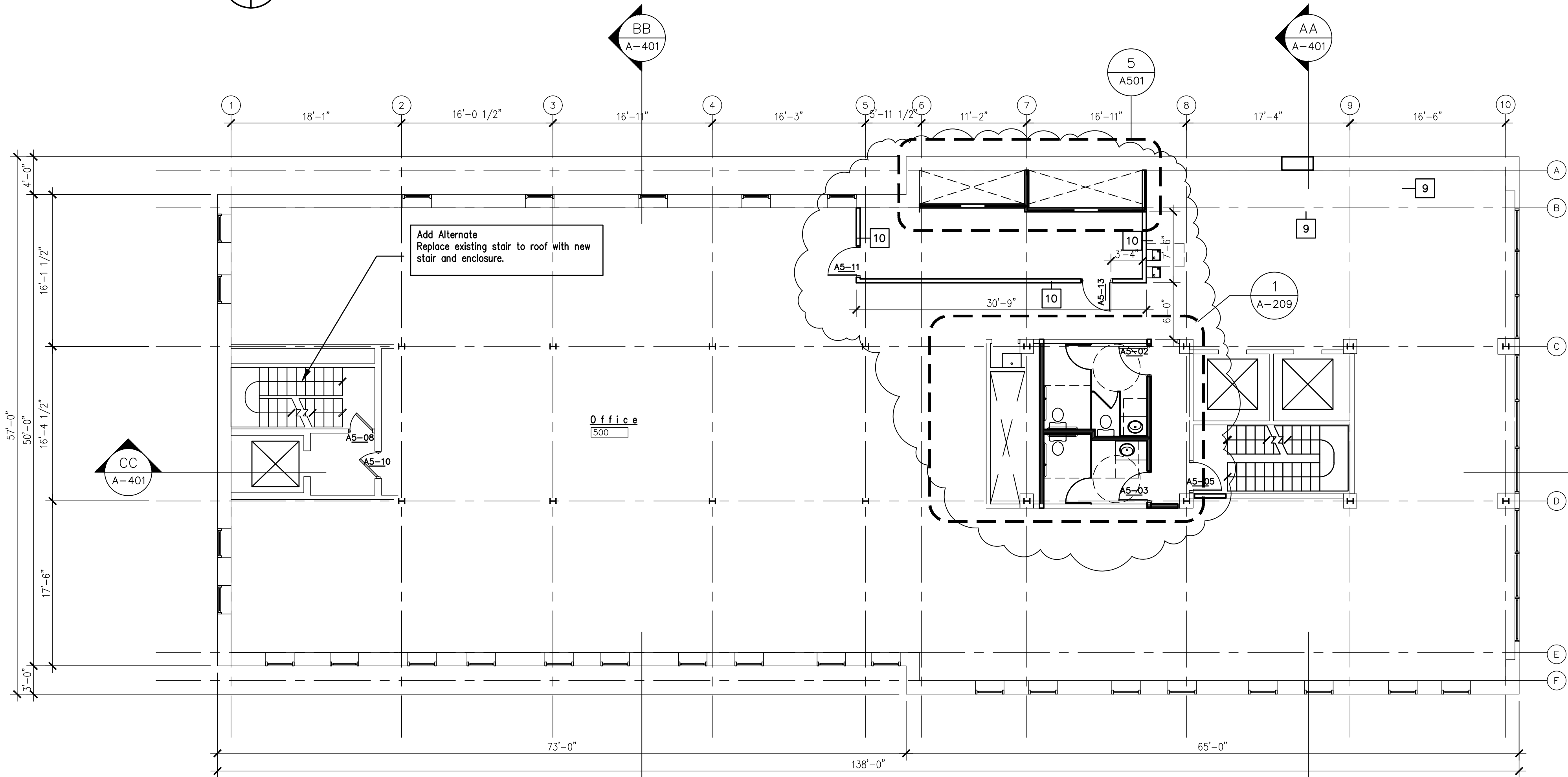
Floor Plan General Notes:
1. Existing electrical receptacles to remain unless noted otherwise.
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3. Remove existing floor finish in area of renovation prepare floor for new floor finish.
4. Replace all missing door hardware

Ceiling Notes:
1. Patch and repair damaged areas of existing gyp bd ceiling
2.

Keynotes:
1. New shaft mechanical duct work.
2. Patch and repair damaged subfloor
3. Gyp bd column enclosure
4. Patch damaged plaster. Mathe existing adjacent finish.
5. New aluminium window and frame
6. New handrail on existing stair.
7. New light fixture see lighting plan for type.
8. New stair enclosure
9. New stair



Fifth Floor Reflected Ceiling Plan
1/8" = 1'-0"



Fifth Floor Plan
1/8" = 1'-0"

For wall
type
designations

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220 W. Congress St., Detroit, MI
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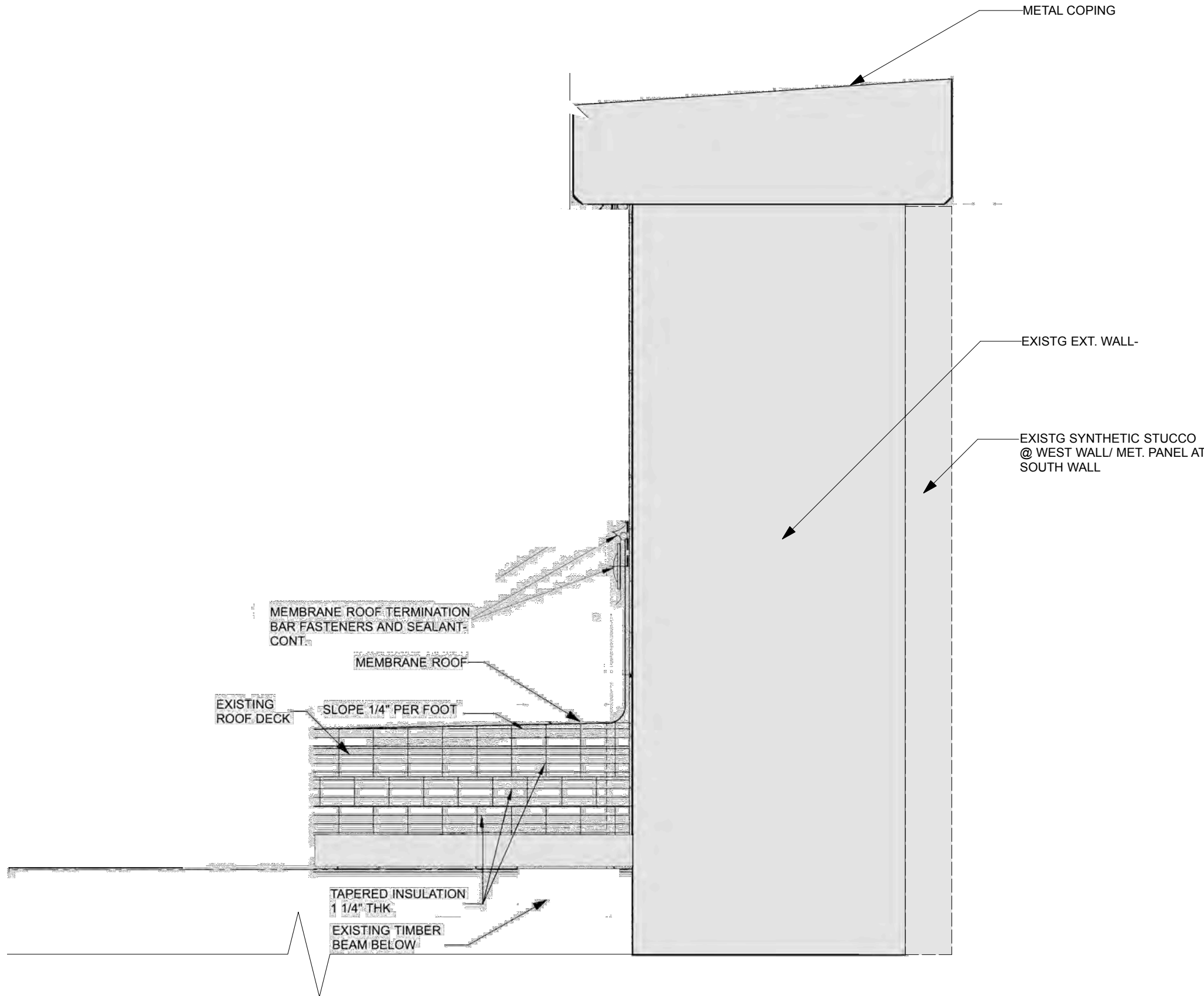
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Fifth Floor Plan

Issued For:	
Interim Des. Dev.	091417
Des. Dev.	101917
70% CD	030118
Bids	062518
Coordination	012819
Bulletin #1	
Bulletin #2	030119
Revisions	050219
Revision 2	6.12.19

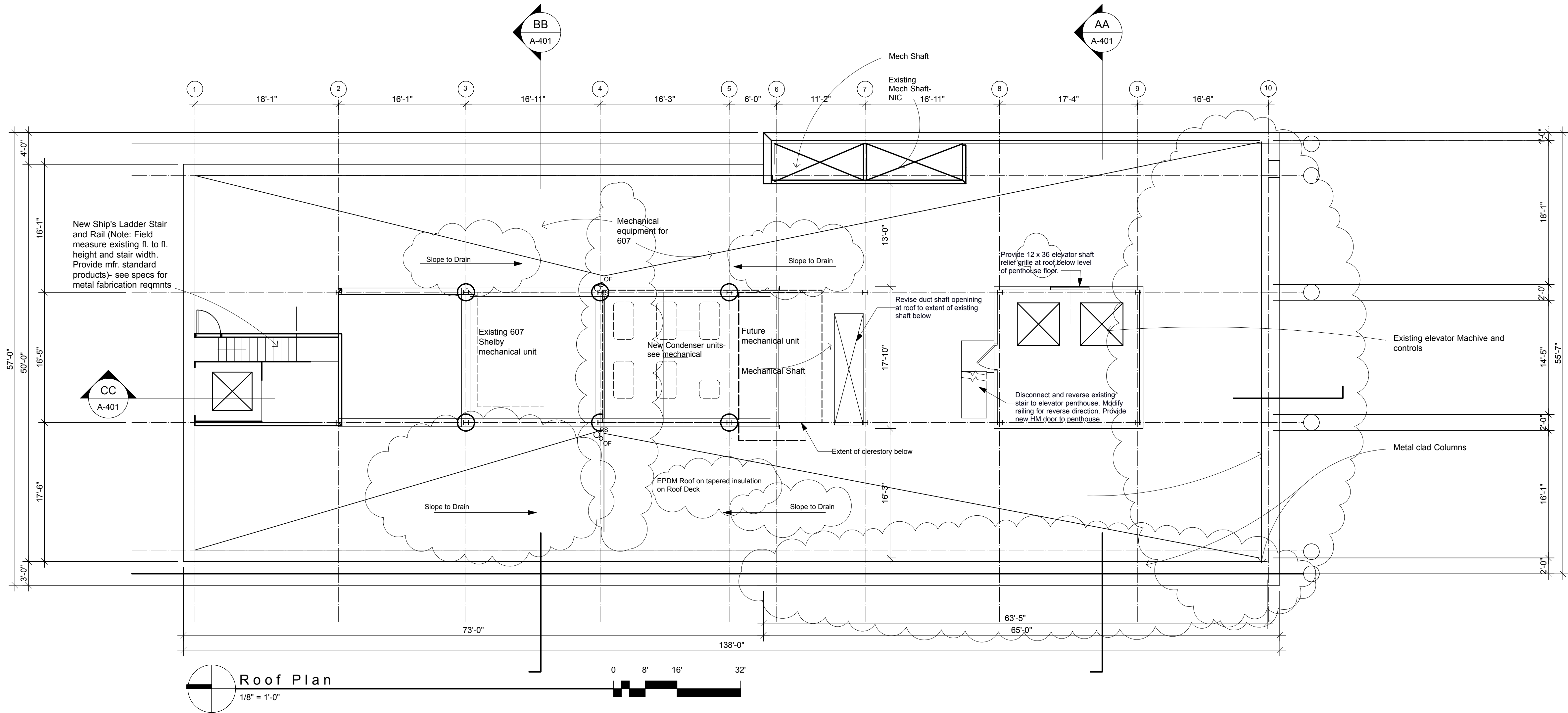
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Approved:
Project Number:
Date: **May 2019**



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1 Parapet Detail @ West Wall (Note south wall sim.)
A-206 NTS



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Roof Plan

Issued For:

Interim Des. Dev. 091417

Des. Dev. 101917

BIDS 06.25.18

PERMITS 08.17.18

REVISION 10.05.18

REVISION 12.11.18

BULLETIN 1 12.28.18

COORDINATION 01.30.19

BULLETIN 2 02.28.19

REVISION #2 06.12.19

Drawn: KC/DM

Checked: DM

Approved: DM



615 GRISWOLD, SUITE 1710

DETROIT, MI 48226

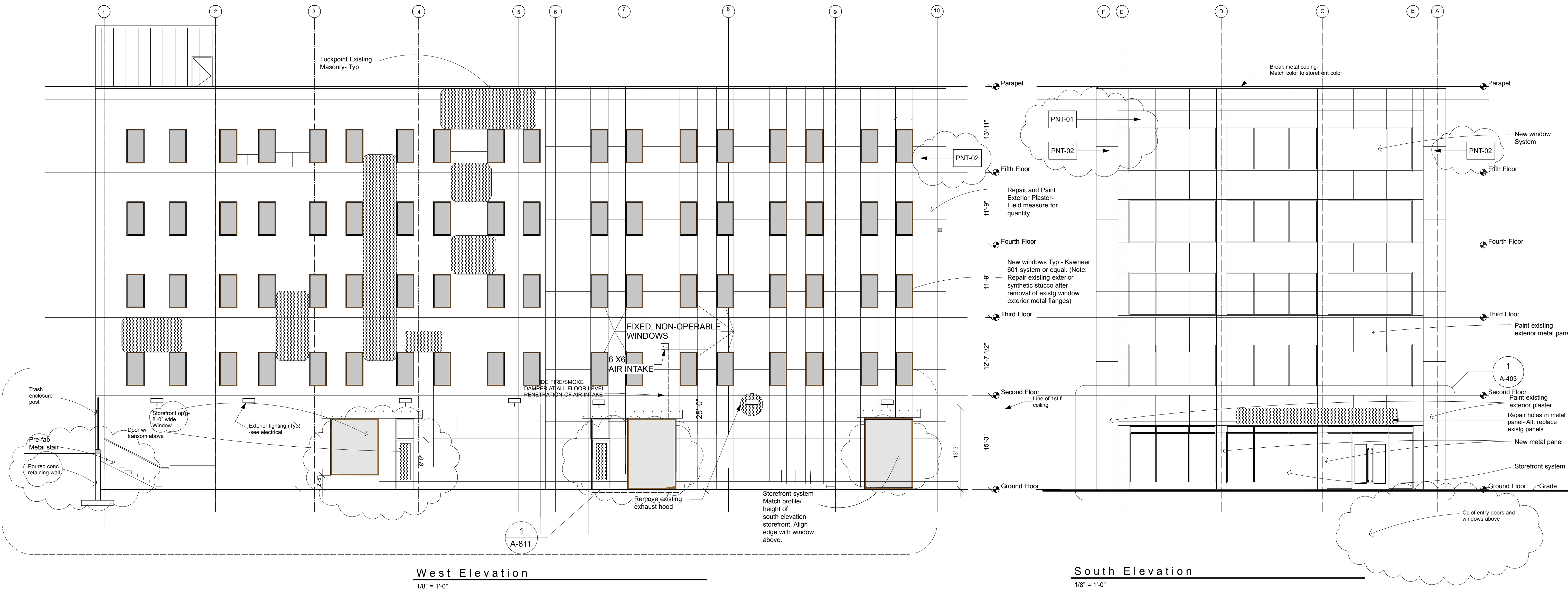
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Exterior Elevations

Issued For:

Interim Des. Dev. 091417

Des. Dev. 101917

Review 050818

BIDS 062518

PERMITS 08.17.18

REVISION 10.05.18

REVISION 12.07.18

COORDINATION 01.30.19

BULLETIN #2 03.01.19

COORDINATION 03.15.19

REVISION #1 05.02.19

REVISION #2 06.12.19

Drawn: KC

Checked: DM

Approved: DM

Project Number:



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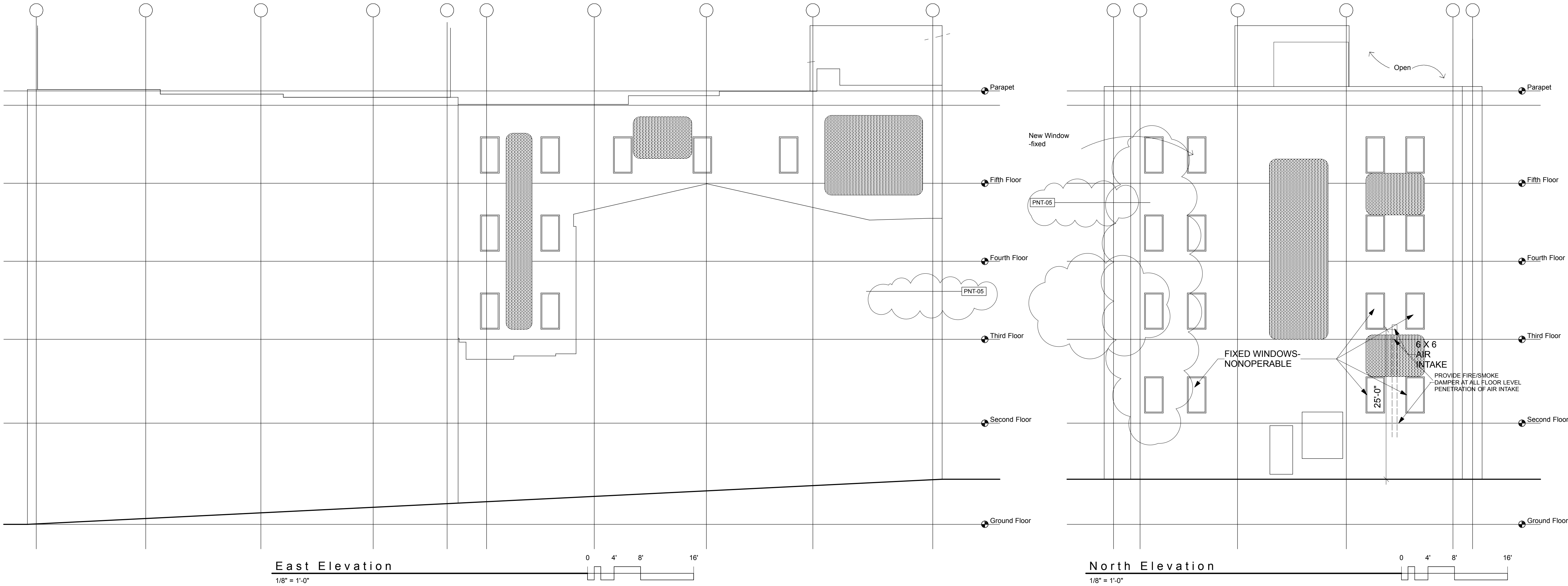
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SHEET NUMBER:

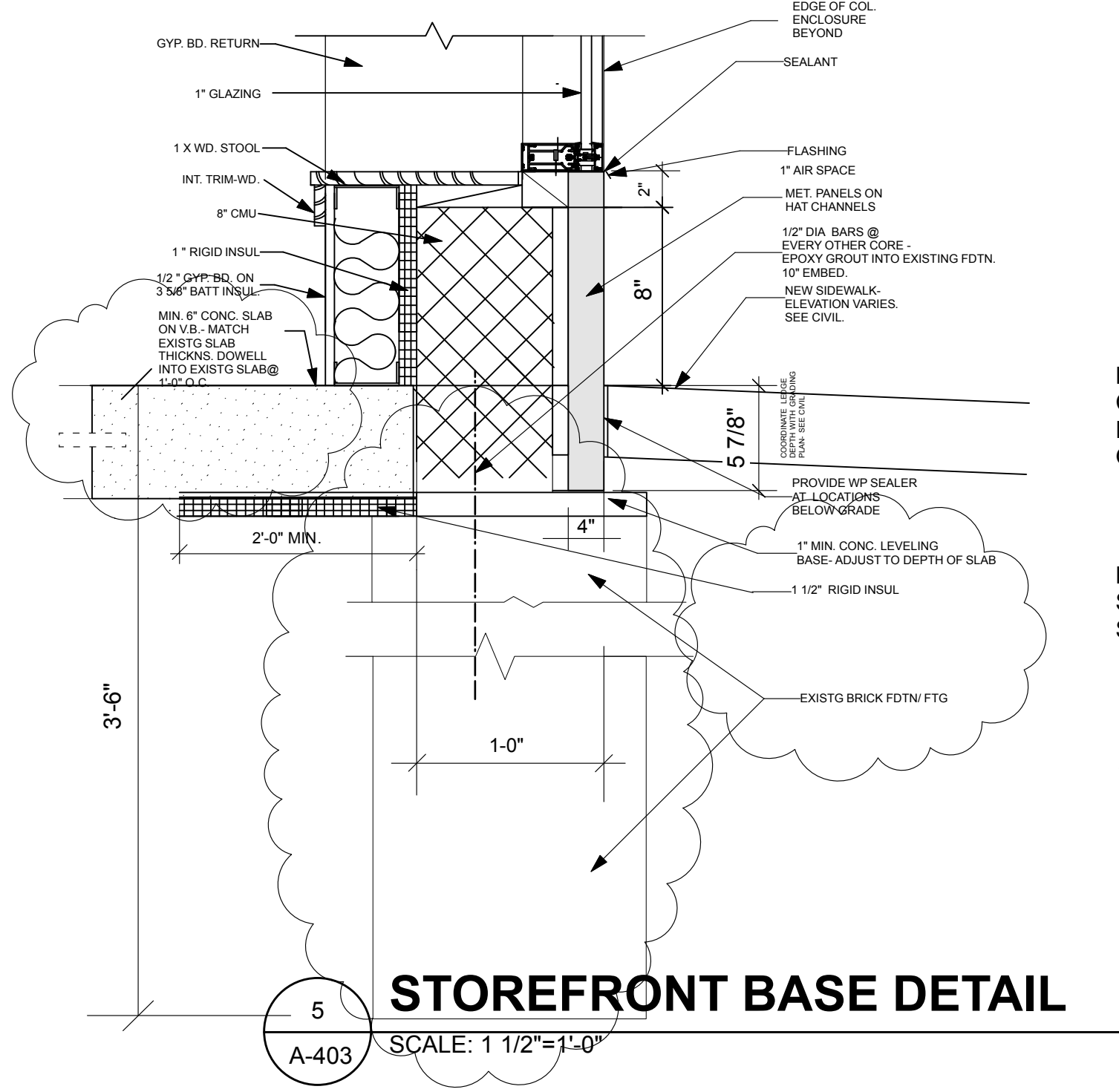
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220 W. Congress St., Detroit, MI
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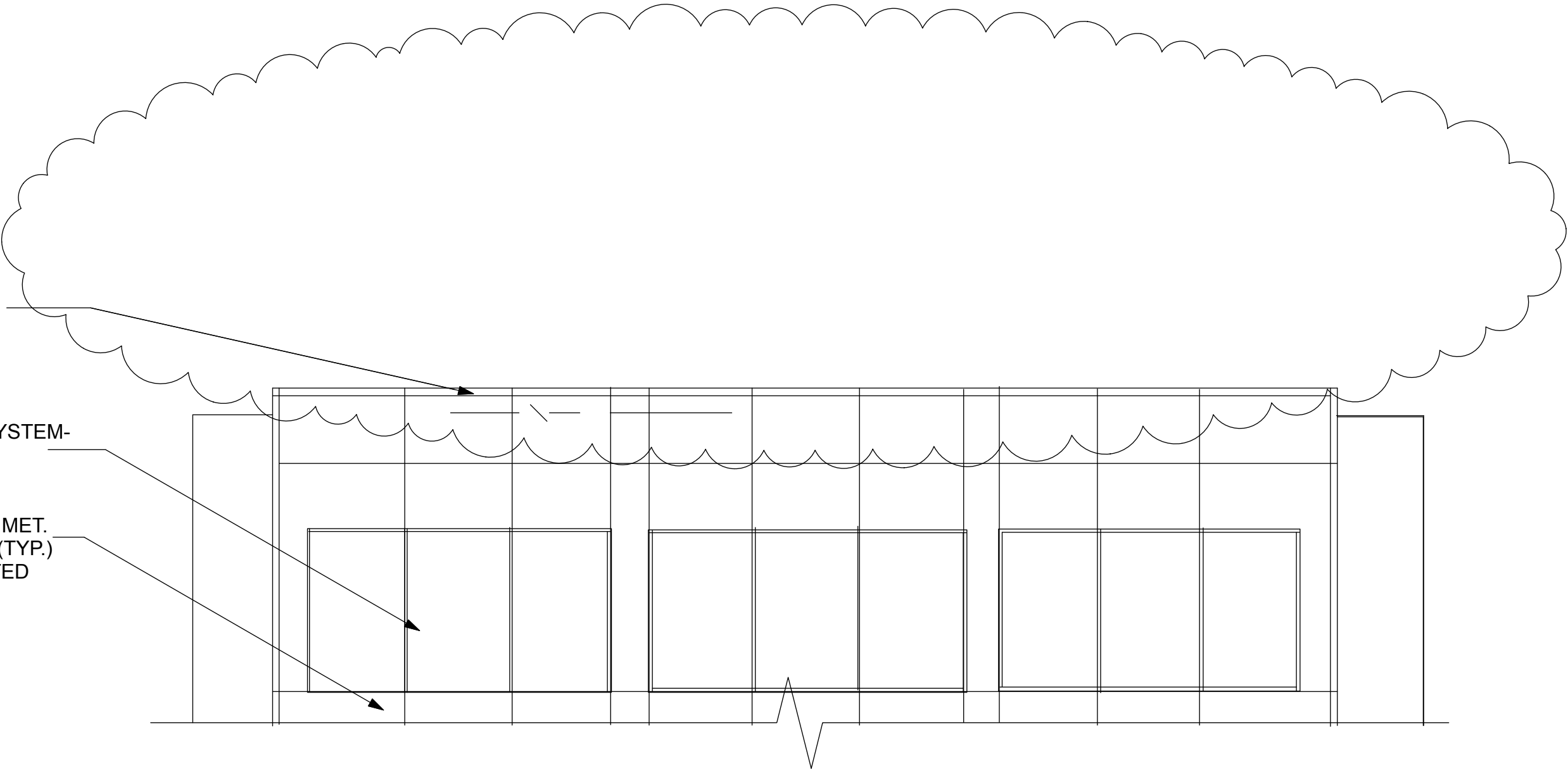
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Exterior Elevations
Issued For:
Interim Des. Dev. 091417
Des. Dev. 101917
Review 05.08.18
PERMIT COMMENTS 10.05.18
BULLETIN 1 12.28.18
COORDINATION 01.30.19
COORDINATION 03.07.19
REVISION 2 06.12.19



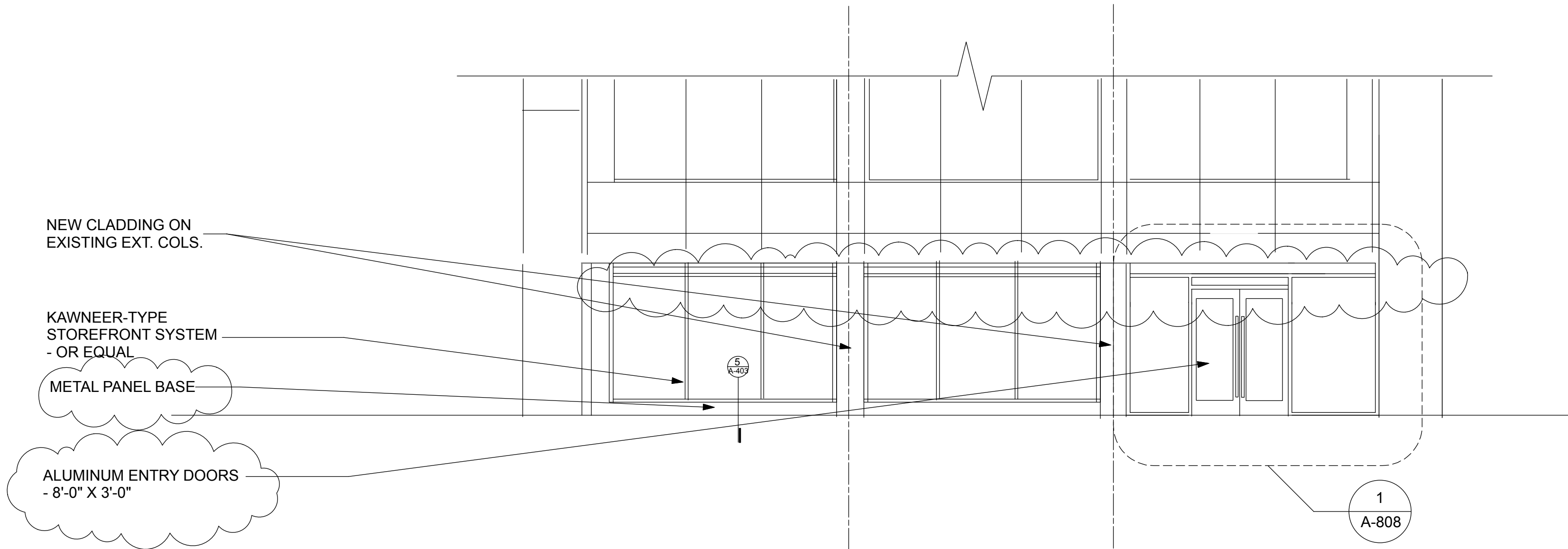
BREAK METAL
COPING-
ENTIRE LENGTH
OF FACADE

KAWNEER-TYPE
STOREFRONT SYSTEM-
SEE SPECS

PAINT EXISTING MET.
PANEL SYSTEM (TYP.)
-COLOR SELECTED
BY ARCHITECT

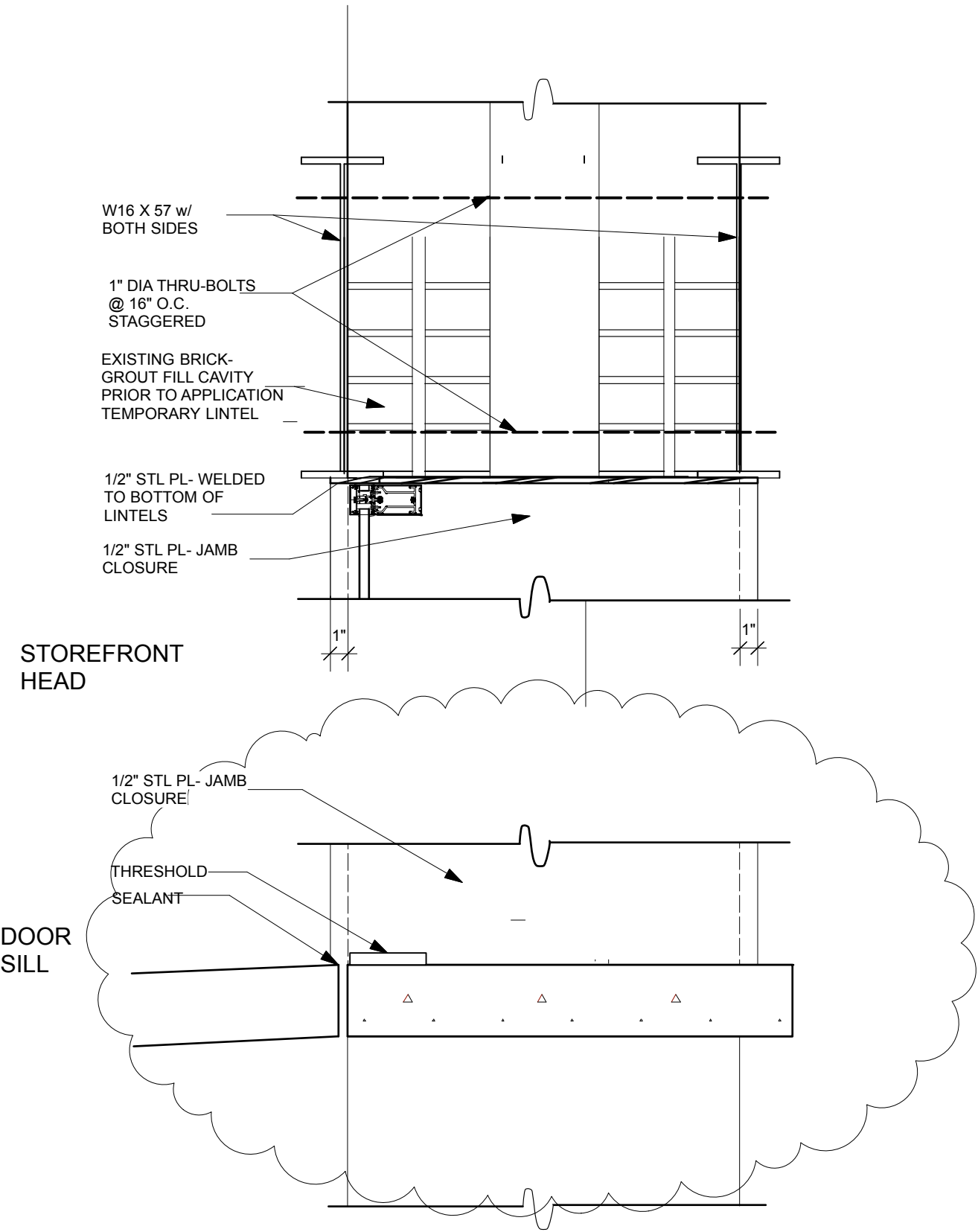


2
A-404
ENLARGED EXTERIOR ELEV AT 5TH FL.
SCALE: 1/4"=1'-0"

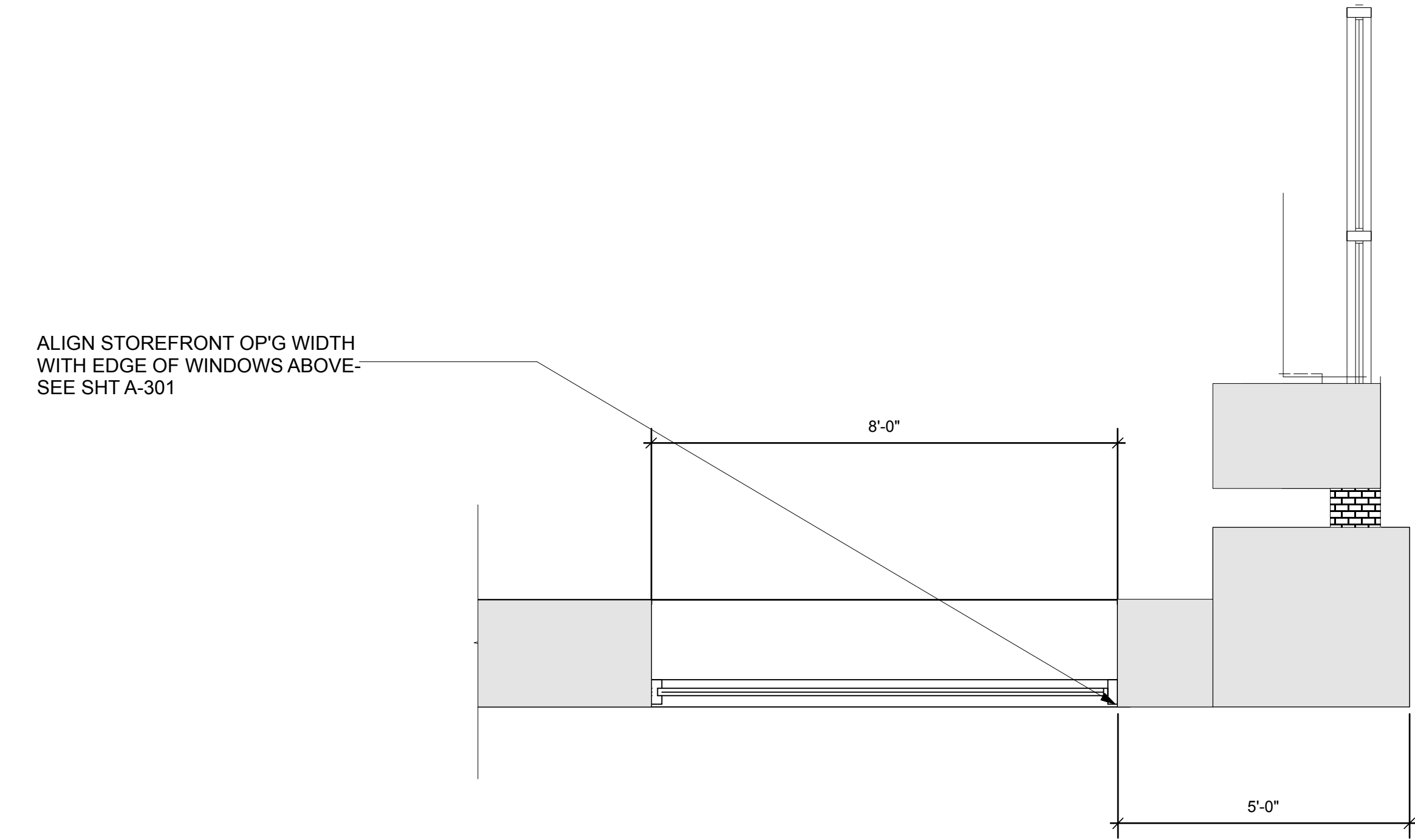


1
A-404
ENLARGED EXTERIOR ELEV AT GROUND LEVEL ENTRY
SCALE: 1/4"=1'-0"

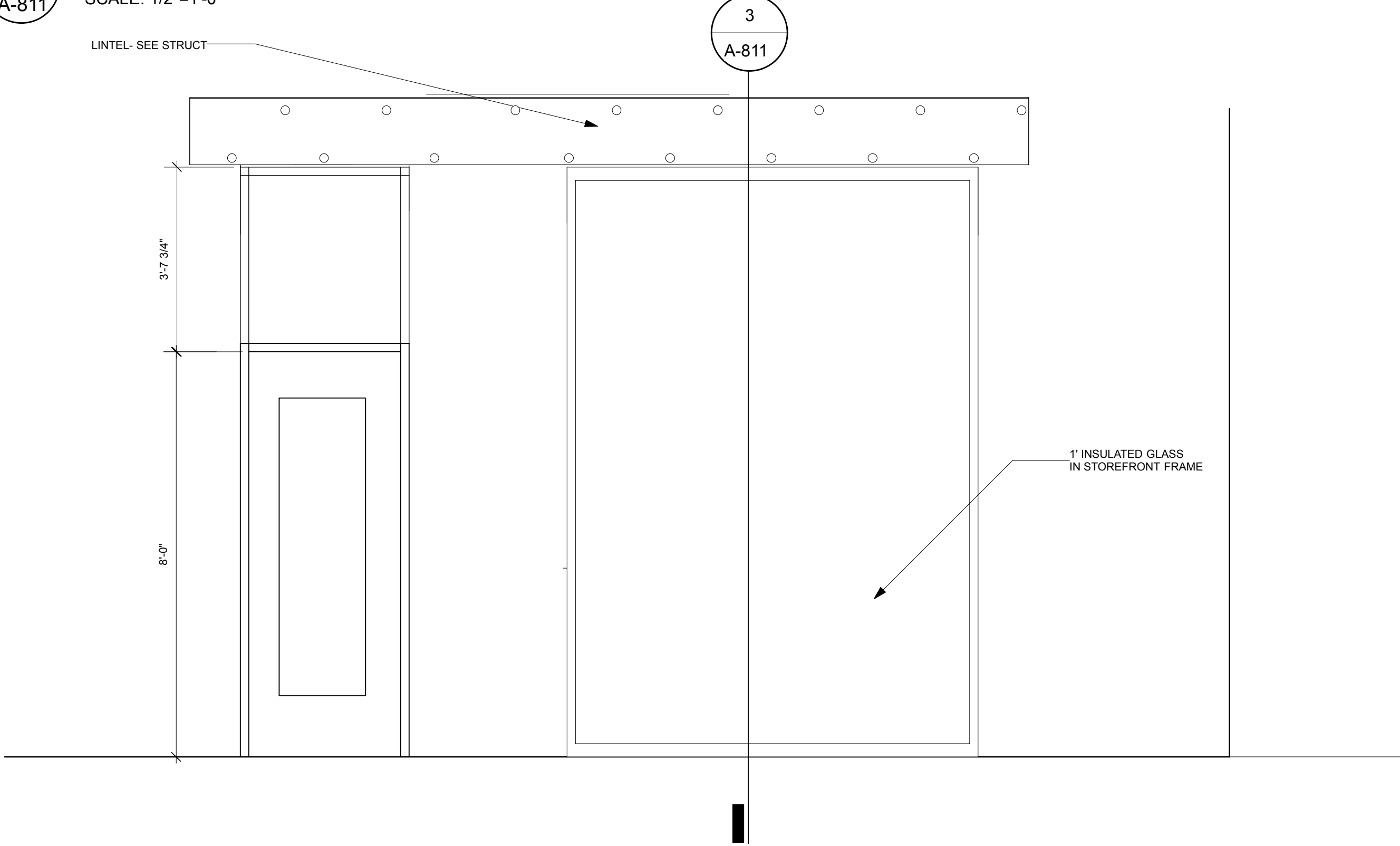
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Enlarged Exterior Elevations	
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3 STOREFRONT OP'G WITH STRUCT REINFORCEMENT
A-811 SCALE: 1 1/2"=1'-0"



2 PARTIAL PLAN AT WEST STOREFRONT
A-811 SCALE: 1/2"=1'-0"



1 PARTIAL ELEV AT WEST STOREFRONT
A-811 SCALE: 1/2"=1'-0"



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STANDARDS FOR REHABILITATION & GUIDELINES FOR REHABILITATING HISTORIC BUILDINGS

Rehabilitation

Rehabilitation is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.



Standards for Rehabilitation

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces and spatial relationships.
2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces and spatial relationships that characterize a property will be avoided.
3. Each property will be recognized as a physical record of its time, place and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.
4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.
5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.
6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.
7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.
8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.
9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work will be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.
10. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

GUIDELINES FOR REHABILITATING HISTORIC BUILDINGS

INTRODUCTION

In **Rehabilitation**, historic building materials and character-defining features are protected and maintained as they are in the treatment Preservation. However, greater latitude is given in the **Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings** to replace extensively deteriorated, damaged, or missing features using either the same material or compatible substitute materials. Of the four treatments, only **Rehabilitation** allows alterations and the construction of a new addition, if necessary for a continuing or new use for the historic building.

Identify, Retain, and Preserve Historic Materials and Features

The guidance for the treatment **Rehabilitation** begins with recommendations to identify the form and detailing of those architectural materials and features that are important in defining the building's historic character and which must be retained to preserve that character. Therefore, guidance on *identifying, retaining, and preserving* character-defining features is always given first.

Protect and Maintain Historic Materials and Features

After identifying those materials and features that are important and must be retained in the process of **Rehabilitation** work, then *protecting and maintaining* them are addressed. Protection generally involves the least degree of intervention and is preparatory to other work. Protection includes the maintenance of historic materials and features as well as ensuring that the property is protected before and

during rehabilitation work. A historic building undergoing rehabilitation will often require more extensive work. Thus, an overall evaluation of its physical condition should always begin at this level.

Repair Historic Materials and Features

Next, when the physical condition of character-defining materials and features warrants additional work, *repairing* is recommended. **Rehabilitation** guidance for the repair of historic materials, such as masonry, again begins with the least degree of intervention possible. In rehabilitation, repairing also includes the limited replacement in kind or with a compatible substitute material of extensively deteriorated or missing components of features when there are surviving prototypes features that can be substantiated by documentary and physical evidence. Although using the same kind of material is always the preferred option, a substitute material may be an acceptable alternative if the form, design, and scale, as well as the substitute material itself, can effectively replicate the appearance of the remaining features.

Replace Deteriorated Historic Materials and Features

Following repair in the hierarchy, **Rehabilitation** guidance is provided for *replacing* an entire character-defining feature with new material because the level of deterioration or damage of materials precludes repair. If the missing feature is character defining or if it is critical to the survival of the building (e.g., a roof), it should be replaced to match the historic feature based on physical or his-

toric documentation of its form and detailing. As with repair, the preferred option is always replacement of the entire feature in kind (i.e., with the same material, such as wood for wood). However, when this is not feasible, a compatible substitute material that can reproduce the overall appearance of the historic material may be considered.

It should be noted that, while the National Park Service guidelines recommend the replacement of an entire character-defining feature that is extensively deteriorated, the guidelines never recommend removal and replacement with new material of a feature that could reasonably be repaired and, thus, preserved.

Design for the Replacement of Missing Historic Features

When an entire interior or exterior feature is missing, such as a porch, it no longer plays a role in physically defining the historic character of the building unless it can be accurately recovered in form and detailing through the process of carefully documenting the historic appearance. If the feature is not critical to the survival of the building, allowing the building to remain without the feature is one option. But if the missing feature is important to the historic character of the building, its replacement is always recommended in the **Rehabilitation** guidelines as the first, or preferred, course of action. If adequate documentary and physical evidence exists, the feature may be accurately reproduced. A second option in a rehabilitation treatment for replacing a missing feature, particularly when the available information about the feature is inadequate to permit an accurate reconstruction, is to *design* a new feature that is compatible with the overall historic character of the building. The new design should always take into account the size, scale, and material of the building itself and should be clearly differentiated from the authentic historic features. For properties that have changed over time, and where those changes have acquired

significance, reestablishing missing historic features generally should not be undertaken if the missing features did not coexist with the features currently on the building. Juxtaposing historic features that did not exist concurrently will result in a false sense of the building's history.

Alterations

Some exterior and interior alterations to a historic building are generally needed as part of a **Rehabilitation** project to ensure its continued use, but it is most important that such alterations do not radically change, obscure, or destroy character-defining spaces, materials, features, or finishes. Alterations may include changes to the site or setting, such as the selective removal of buildings or other features of the building site or setting that are intrusive, not character defining, or outside the building's period of significance.

Code-Required Work: Accessibility and Life Safety

Sensitive solutions to meeting code requirements in a **Rehabilitation** project are an important part of protecting the historic character of the building. Work that must be done to meet accessibility and life-safety requirements must also be assessed for its potential impact on the historic building, its site, and setting.

Resilience to Natural Hazards

Resilience to natural hazards should be addressed as part of a **Rehabilitation** project. A historic building may have existing characteristics or features that help to address or minimize the impacts of natural hazards. These should always be used to best advantage when considering new adaptive treatments so as to have the least impact on the historic character of the building, its site, and setting.

Sustainability

Sustainability should be addressed as part of a **Rehabilitation** project. Good preservation practice is often synonymous with sustainability. Existing energy-efficient features should be retained and repaired. Only sustainability treatments should be considered that will have the least impact on the historic character of the building.

The topic of sustainability is addressed in detail in *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings*.

New Exterior Additions and Related New Construction

Rehabilitation is the only treatment that allows expanding a historic building by enlarging it with an addition. However, the **Rehabilitation** guidelines emphasize that new additions should be considered only after it is determined that meeting specific new needs cannot be achieved by altering non-character-defining interior spaces. If the use cannot be accommodated in this way, then an attached exterior addition may be considered. New additions should be designed and constructed so that the character-defining features of the historic building, its site, and setting are not negatively impacted. Generally, a new addition should be subordinate to the historic building. A new addition should be compatible, but differentiated enough so that it is not confused as historic or original to the building. The same guidance applies to new construction so that it does not negatively impact the historic character of the building or its site.

Rehabilitation as a Treatment. *When repair and replacement of deteriorated features are necessary; when alterations or additions to the property are planned for a new or continued use; and when its depiction at a particular time is not appropriate, Rehabilitation may be considered as a treatment. Prior to undertaking work, a documentation plan for Rehabilitation should be developed.*

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED

Identifying, retaining and preserving masonry features that are important in defining the overall historic character of the building (such as walls, brackets, railings, cornices, window and door surrounds, steps, and columns) and decorative ornament and other details, such as tooling and bonding patterns, coatings, and color.

Protecting and maintaining masonry by ensuring that historic drainage features and systems that divert rainwater from masonry surfaces (such as roof overhangs, gutters, and downspouts) are intact and functioning properly.

Cleaning masonry only when necessary to halt deterioration or remove heavy soiling.

Carrying out masonry cleaning tests when it has been determined that cleaning is appropriate. Test areas should be examined to ensure that no damage has resulted and, ideally, monitored over a sufficient period of time to allow long-range effects to be predicted.

NOT RECOMMENDED

Removing or substantially changing masonry features which are important in defining the overall historic character of the building so that, as a result, the character is diminished.

Replacing or rebuilding a major portion of exterior masonry walls that could be repaired, thereby destroying the historic integrity of the building.

Applying paint or other coatings (such as stucco) to masonry that has been historically unpainted or uncoated to create a new appearance.

Removing paint from historically-painted masonry.

Failing to identify and treat the causes of masonry deterioration, such as leaking roofs and gutters or rising damp.

Cleaning masonry surfaces when they are not heavily soiled to create a “like-new” appearance, thereby needlessly introducing chemicals or moisture into historic materials.

Cleaning masonry surfaces without testing or without sufficient time for the testing results to be evaluated.



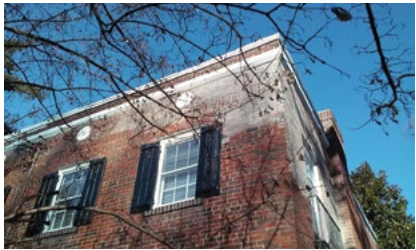
[1] An alkaline-based product is appropriate to use to clean historic marble because it will not damage the marble, which is acid sensitive.



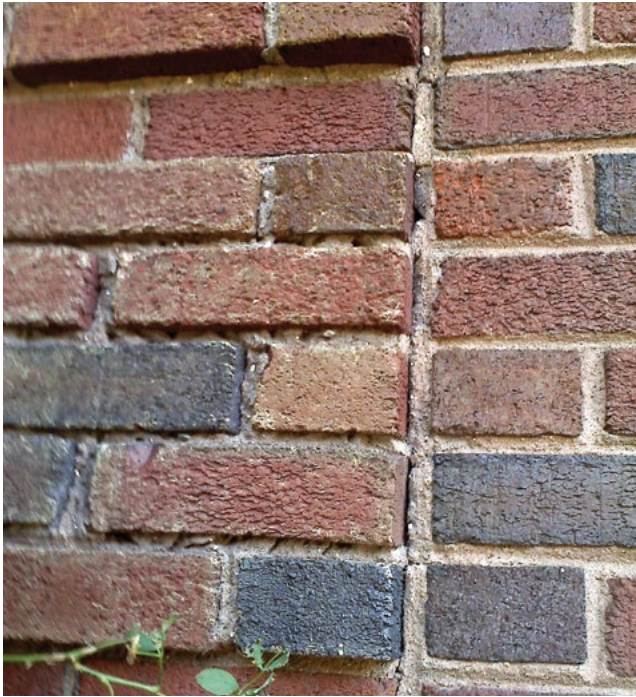
[2] Mid-century modern building technology made possible the form of this parabola-shaped structure and its thin concrete shell construction. Built in 1961 as the lobby of the La Concha Motel in Las Vegas, it was designed by Paul Revere Williams, one of the first prominent African-American architects. It was moved to a new location and rehabilitated to serve as the Neon Museum, and is often cited as an example of Google architecture. *Credit: Photographed with permission at The Neon Museum, Las Vegas, Nevada.*

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Cleaning soiled masonry surfaces with the gentlest method possible, such as using low-pressure water and detergent and natural bristle or other soft-bristle brushes.	Cleaning or removing paint from masonry surfaces using most abrasive methods (including sandblasting, other media blasting, or high-pressure water) which can damage the surface of the masonry and mortar joints.
	Using a cleaning or paint-removal method that involves water or liquid chemical solutions when there is any possibility of freezing temperatures.
	Cleaning with chemical products that will damage some types of masonry (such as using acid on limestone or marble), or failing to neutralize or rinse off chemical cleaners from masonry surfaces.



[3] **Not Recommended:**
The white film on the upper corner of this historic brick row house is the result of using a scrub or slurry coating, rather than traditional repointing by hand, which is the recommended method.



[4] **Not Recommended:**
The quoins on the left side of the photo show that high-pressure abrasive blasting used to remove paint can damage even early 20th-century, hard-baked, textured brick and erode the mortar, whereas the same brick on the right, which was not abrasively cleaned, is undamaged.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Using biodegradable or environmentally-safe cleaning or paint-removal products.	
Using paint-removal methods that employ a poultice to which paint adheres, when possible, to neatly and safely remove old lead paint.	
Using coatings that encapsulate lead paint, when possible, where the paint is not required to be removed to meet environmental regulations.	
Allowing only trained conservators to use abrasive or laser-cleaning methods, when necessary, to clean hard-to-reach, highly-carved, or detailed decorative stone features.	
Removing damaged or deteriorated paint only to the next sound layer using the gentlest method possible (e.g., hand scraping) prior to repainting.	Removing paint that is firmly adhered to masonry surfaces, unless the building was unpainted historically and the paint can be removed without damaging the surface.
Applying compatible paint coating systems to historically-painted masonry following proper surface preparation.	Failing to follow manufacturers' product and application instructions when repainting masonry features.
Repainting historically-painted masonry features with colors that are appropriate to the historic character of the building and district.	Using paint colors on historically-painted masonry features that are not appropriate to the historic character of the building and district.
Protecting adjacent materials when cleaning or removing paint from masonry features.	Failing to protect adjacent materials when cleaning or removing paint from masonry features.
Evaluating the overall condition of the masonry to determine whether more than protection and maintenance, such as repairs to masonry features, will be necessary.	Failing to undertake adequate measures to ensure the protection of masonry features.
Repairing masonry by patching, splicing, consolidating, or otherwise reinforcing the masonry using recognized preservation methods. Repair may include the limited replacement in kind or with a compatible substitute material of those extensively deteriorated or missing parts of masonry features when there are surviving prototypes, such as terra-cotta brackets or stone balusters.	<p>Removing masonry that could be stabilized, repaired, and conserved, or using untested consolidants and unskilled personnel, potentially causing further damage to historic materials.</p> <p>Replacing an entire masonry feature, such as a cornice or balustrade, when repair of the masonry and limited replacement of deteriorated or missing components are feasible.</p>

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED	NOT RECOMMENDED
Repairing masonry walls and other masonry features by repointing the mortar joints where there is evidence of deterioration, such as disintegrating mortar, cracks in mortar joints, loose bricks, or damaged plaster on the interior.	Removing non-deteriorated mortar from sound joints and then repointing the entire building to achieve a more uniform appearance.
Removing deteriorated lime mortar carefully by hand raking the joints to avoid damaging the masonry.	
Using power tools only on horizontal joints on brick masonry in conjunction with hand chiseling to remove hard mortar that is deteriorated or that is a non-historic material which is causing damage to the masonry units. Mechanical tools should be used only by skilled masons in limited circumstances and generally not on short, vertical joints in brick masonry.	Allowing unskilled workers to use masonry saws or mechanical tools to remove deteriorated mortar from joints prior to repointing.
Duplicating historic mortar joints in strength, composition, color, and texture when repointing is necessary. In some cases, a lime-based mortar may also be considered when repointing Portland cement mortar because it is more flexible.	Repointing masonry units with mortar of high Portland cement content (unless it is the content of the historic mortar). Using “surface grouting” or a “scrub” coating technique, such as a “sack rub” or “mortar washing,” to repoint exterior masonry units instead of traditional repointing methods. Repointing masonry units (other than concrete) with a synthetic caulking compound instead of mortar.
Duplicating historic mortar joints in width and joint profile when repointing is necessary.	Changing the width or joint profile when repointing.
Repairing stucco by removing the damaged material and patching with new stucco that duplicates the old in strength, composition, color, and texture.	Removing sound stucco or repairing with new stucco that is different in composition from the historic stucco. Patching stucco or concrete without removing the source of deterioration. Replacing deteriorated stucco with synthetic stucco, an exterior finish and insulation system (EFIS), or other non-traditional materials.

MASONRY: STONE, BRICK, TERRA COTTA, CONCRETE, ADOBE, STUCCO, AND MORTAR

RECOMMENDED

NOT RECOMMENDED

Using mud plaster or a compatible lime-plaster adobe render, when appropriate, to repair adobe.	Applying cement stucco, unless it already exists, to adobe.
Sealing joints in concrete with appropriate flexible sealants and backer rods, when necessary.	
Cutting damaged concrete back to remove the source of deterioration, such as corrosion on metal reinforcement bars. The new patch must be applied carefully so that it will bond satisfactorily with and match the historic concrete.	Patching damaged concrete without removing the source of deterioration.



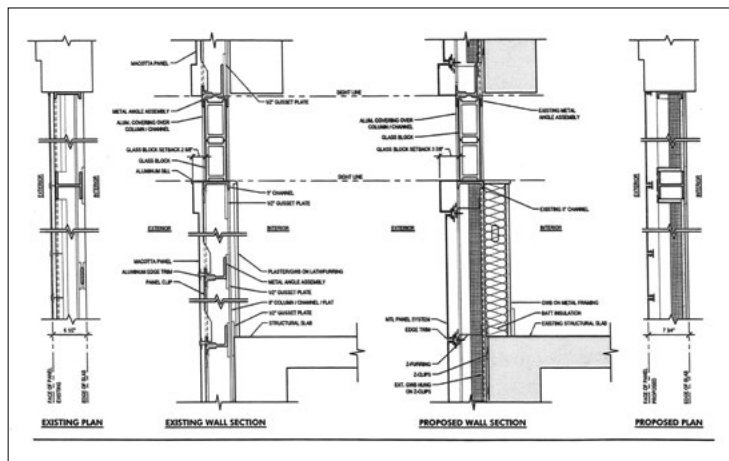
[5] Rebars in the reinforced concrete ceiling have rusted, causing the concrete to spall. The rebars must be cleaned of rust before the concrete can be patched.

[6] Some areas of the concrete brise soleil screen on this building constructed in 1967 are badly deteriorated. If the screen cannot be repaired, it may be replaced in kind or with a composite substitute material with the same appearance as the concrete.





[7] (a) J.W. Knapp's Department Store, built 1937-38, in Lansing, MI, was constructed with a proprietary material named "Maul Macotta" made of enameled steel and cast-in-place concrete panels. Prior to its rehabilitation, a building inspection revealed that, due to a flaw in the original design and construction, the material was deteriorated beyond repair. The architects for the rehabilitation project devised a replacement system (b) consisting of enameled aluminum panels that matched the original colors (c). Photos and drawing (a-b): Quinn Evans Architects; Photo (c): James Haefner Photography.





Keeping it Clean

Removing Exterior Dirt, Paint,
Stains and Graffiti from
Historic Masonry Buildings

1 PRESERVATION BRIEFS

Assessing Cleaning and Water-Repellent Treatments for Historic Masonry Buildings

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Inappropriate cleaning and coating treatments are a major cause of damage to historic masonry buildings. While either or both treatments may be appropriate in some cases, they can be very destructive to historic masonry if they are not selected carefully. Historic masonry, as considered here, includes stone, brick, architectural terra cotta, cast stone, concrete and concrete block. It is frequently cleaned because cleaning is equated with improvement. Cleaning may sometimes be followed by the application of a water-repellent coating. However, unless these procedures are carried out under the guidance and supervision of an architectural conservator, they may result in irrevocable damage to the historic resource.

The purpose of this Brief is to provide information on the variety of cleaning methods and materials that are available for use on the *exterior* of historic masonry buildings, and to provide guidance in selecting the most appropriate method or combination of methods. The difference between

water-repellent coatings and waterproof coatings is explained, and the purpose of each, the suitability of their application to historic masonry buildings, and the possible consequences of their inappropriate use are discussed.

The Brief is intended to help develop sensitivity to the qualities of historic masonry that makes it so special, and to assist historic building owners and property managers in working cooperatively with architects, architectural conservators and contractors (Fig. 1). Although specifically intended for historic buildings, the information is applicable to all masonry buildings. This publication updates and expands *Preservation Brief 1: The Cleaning and Waterproof Coating of Masonry Buildings*. The Brief is not meant to be a cleaning manual or a guide for preparing specifications. Rather, it provides general information to raise awareness of the many factors involved in selecting cleaning and water-repellent treatments for historic masonry buildings.



Figure 1. Low-to medium-pressure steam (hot-pressurized water washing), is being used to clean the exterior of the U.S. Tariff Commission Building, the first marble building constructed in Washington, D.C., in 1839. This method was selected by an architectural conservator as the "gentlest means possible" to clean the marble. Steam can soften heavy soiling deposits such as those on the cornice and column capitals, and facilitate easy removal. Note how these deposits have been removed from the right side of the cornice which has already been cleaned.

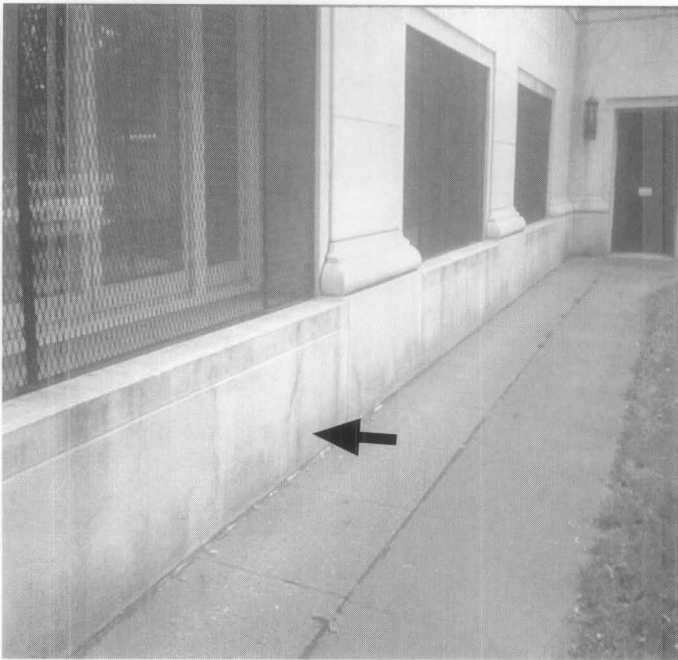


Figure 2. Biological growth as shown on this marble foundation can usually be removed using a low-pressure water wash, possibly with a non-ionic detergent added to it, and scrubbing with a natural or synthetic bristle brush.



Figure 3. This small test area has revealed a red brick patch that does not match the original beige brick. This may explain why the building was painted, and may suggest to the owner that it may be preferable to keep it painted.

Preparing for a Cleaning Project

Reasons for cleaning. First, it is important to determine whether it is appropriate to clean the masonry. The objective of cleaning a historic masonry building must be considered carefully before arriving at a decision to clean. There are several major reasons for cleaning a historic masonry building: **improve the appearance of the building** by removing unattractive dirt or soiling materials, or non-historic paint from the masonry; **retard deterioration** by removing soiling materials that may be damaging the masonry; or **provide a clean surface** to accurately match repointing mortars or patching compounds, or to conduct a condition survey of the masonry.

Identify what is to be removed. The general nature and source of dirt or soiling material on a building must be identified to remove it in the *gentlest means possible* — that is, in the most effective, yet least harmful, manner. Soot and smoke, for example, require a different cleaning agent to remove than oil stains or metallic stains. Other common cleaning problems include biological growth such as mold or mildew, and organic matter such as the tendrils left on masonry after removal of ivy (Fig. 2).

Consider the historic appearance of the building. If the proposed cleaning is to remove paint, it is important in each case to learn whether or not unpainted masonry is historically appropriate. And, it is necessary to consider why the building was painted (Fig. 3). Was it to cover bad repointing or unmatched repairs? Was the building painted to protect soft brick or to conceal deteriorating stone? Or, was painted masonry simply a fashionable

treatment in a particular historic period? Many buildings were painted at the time of construction or shortly thereafter; retention of the paint, therefore, may be more appropriate historically than removing it. And, if the building appears to have been painted for a long time, it is also important to think about whether the paint is part of the character of the historic building and if it has acquired significance over time.

Consider the practicalities of cleaning or paint removal. Some gypsum or sulfate crusts may have become integral with the stone and, if cleaning could result in removing some of the stone surface, it may be preferable not to clean. Even where unpainted masonry is appropriate, the retention of the paint may be more practical than removal in terms of long range preservation of the masonry. In some cases, however, removal of the paint may be desirable. For example, the old paint layers may have built up to such an extent that removal is necessary to ensure a sound surface to which the new paint will adhere.

Study the masonry. Although not always necessary, in some instances it can be beneficial to have the coating or paint type, color, and layering on the masonry researched before attempting its removal. Analysis of the nature of the soiling or of the paint to be removed from the masonry, as well as guidance on the appropriate cleaning method, may be provided by professional consultants, including architectural conservators, conservation scientists and preservation architects. The State Historic Preservation Office (SHPO), local historic district commissions, architectural review boards and preservation-oriented websites may also be able to supply useful information on masonry cleaning techniques.

Understanding the Building Materials

The construction of the building must be considered when developing a cleaning program because inappropriate cleaning can have a deleterious effect on the masonry as well as on other building materials. The masonry material or materials must be correctly identified. It is sometimes difficult to distinguish one type of stone from another; for example, certain sandstones can be easily confused with limestones. Or, what appears to be natural stone may not be stone at all, but cast stone or concrete. Historically, cast stone and architectural terra cotta were frequently used in combination with natural stone, especially for trim elements or on upper stories of a building where, from a distance, these substitute materials looked like real stone (Fig. 4). Other features on historic buildings that appear to be stone, such as decorative cornices, entablatures and window hoods, may not even be masonry, but metal.

Identify prior treatments. Previous treatments of the building and its surroundings should be researched and building maintenance records should be obtained, if available. Sometimes if streaked or spotty areas do not seem to get cleaner following an initial cleaning, closer inspection and analysis may be warranted. The discoloration may turn out not to be dirt but the remnant of a water-repellent coating applied long ago which has darkened the surface of the masonry over time (Fig. 5). Successful removal may require testing several cleaning agents to find something that will dissolve and remove the coating. Complete removal may not always be possible. Repairs may have been stained to match a dirty building, and cleaning may make these differences apparent. De-icing salts used near the building that have dissolved can



Figure 4. The foundation of this brick building is limestone, but the decorative trim above is architectural terra cotta intended to simulate stone.



Figure 5. Repeated water washing did not remove the staining inside this limestone porte cochere. Upon closer examination, it was determined to be a water-repellent coating that had been applied many years earlier. An alkaline cleaner may be effective in removing it.

migrate into the masonry. Cleaning may draw the salts to the surface, where they will appear as efflorescence (a powdery, white substance), which may require a second treatment to be removed. Allowances for dealing with such unknown factors, any of which can be a potential problem, should be included when investigating cleaning methods and materials. Just as more than one kind of masonry on a historic building may necessitate multiple cleaning approaches, unknown conditions that are encountered may also require additional cleaning treatments.

Choose the appropriate cleaner. The importance of testing cleaning methods and materials cannot be over emphasized. Applying the wrong cleaning agents to historic masonry can have disastrous results. Acidic cleaners can be extremely damaging to acid-sensitive stones, such as marble and limestone, resulting in etching and dissolution of these stones. Other kinds of masonry can also be damaged by incompatible cleaning agents, or even by cleaning agents that are usually compatible. There are also numerous kinds of sandstone, each with a considerably different geological composition. While an acid-based cleaner may be safely used on some sandstones, others are acid-sensitive and can be severely etched or dissolved by an acid cleaner. Some sandstones contain water-soluble minerals and can be eroded by water cleaning. And, even if the stone type is correctly identified, stones, as well as some bricks, may contain unexpected impurities, such as iron particles, that may react negatively with a particular cleaning agent and result in staining. Thorough understanding of the physical and chemical properties of the masonry will help avoid the inadvertent selection of damaging cleaning agents.

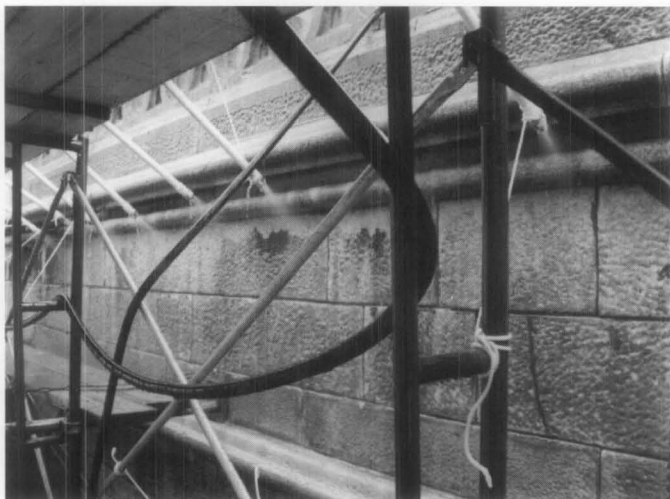


Figure 6. Timed water soaking can be very effective for cleaning limestone and marble as shown here at the Marble Collegiate Church in New York City. In this case, a twelve-hour water soak using a multi-nozzle manifold was followed by a final water rinse. Photo: Diane S. Kaese, Wiss, Janney, Elstner Associates, Inc., N.Y., N.Y.

Other building materials also may be affected by the cleaning process. Some chemicals, for example, may have a corrosive effect on paint or glass. The portions of building elements most vulnerable to deterioration may not be visible, such as embedded ends of iron window bars. Other totally unseen items, such as iron cramps or ties which hold the masonry to the structural frame, also may be subject to corrosion from the use of chemicals or even from plain water. The only way to prevent problems in these cases is to study the building construction in detail and evaluate proposed cleaning methods with this information in mind. However, due to the very likely possibility of encountering unknown factors, any cleaning project involving historic masonry should be viewed as unique to that particular building.

Cleaning Methods and Materials

Masonry cleaning methods generally are divided into three major groups: water, chemical, and abrasive. *Water methods* soften the dirt or soiling material and rinse the deposits from the masonry surface. *Chemical cleaners* react with dirt, soiling material or paint to effect their removal, after which the cleaning effluent is rinsed off the masonry surface with water. *Abrasive methods* include blasting with grit, and the use of grinders and sanding discs, all of which mechanically remove the dirt, soiling material or paint (and, usually, some of the masonry surface). Abrasive cleaning is also often followed with a water rinse. *Laser cleaning*, although not discussed here in detail, is another technique that is used sometimes by conservators to clean small areas of historic masonry. It can be quite effective for cleaning limited areas, but it is expensive and generally not practical for most historic masonry cleaning projects.

Although it may seem contrary to common sense, masonry cleaning projects should be carried out starting at the

bottom and proceeding to the top of the building always keeping all surfaces wet below the area being cleaned. The rationale for this approach is based on the principle that dirty water or cleaning effluent dripping from cleaning in progress above will leave streaks on a dirty surface but will not streak a clean surface as long as it is kept wet and rinsed frequently.

Water Cleaning

Water cleaning methods are generally the *gentlest means possible*, and they can be used safely to remove dirt from all types of historic masonry.* There are essentially four kinds of water-based methods: soaking; pressure water washing; water washing supplemented with non-ionic detergent; and steam, or hot-pressurized water cleaning. Once water cleaning has been completed, it is often necessary to follow up with a water rinse to wash off the loosened soiling material from the masonry.

Soaking. Prolonged spraying or misting with water is particularly effective for cleaning limestone and marble. It is also a good method for removing heavy accumulations of soot, sulfate crusts or gypsum crusts that tend to form in protected areas of a building not regularly washed by rain. Water is distributed to lengths of punctured hose or pipe with non-ferrous fittings hung from moveable scaffolding or a swing stage that continuously mists the surface of the masonry with a very fine spray (Fig. 6). A timed on-off spray is another approach to using this cleaning technique. After one area has been cleaned, the apparatus is moved on to another. Soaking is often used in combination with water washing and is also followed by a final water rinse. Soaking is a very slow method — it may take several days or a week—but it is a very gentle method to use on historic masonry.

Water Washing. Washing with low-pressure or medium-pressure water is probably one of the most commonly used methods for removing dirt or other pollutant soiling from historic masonry buildings (Fig. 7). Starting with a very low pressure (100 psi or below), even using a garden hose, and progressing as needed to slightly higher pressure —generally no higher than 300-400 psi —is always the recommended way to begin. Scrubbing with natural bristle or synthetic bristle brushes—never metal which can abrade the surface and leave metal particles that can stain the masonry—can help in cleaning areas of the masonry that are especially dirty.

Water Washing with Detergents. Non-ionic detergents—which are not the same as soaps—are synthetic organic compounds that are especially effective in removing oily soil. (Examples of some of the numerous proprietary non-ionic detergents include Igepal by GAF, Tergitol by Union Carbide and Triton by Rohm & Haas.) Thus, the addition of a non-ionic detergent, or surfactant, to a low- or medium-pressure water wash can be a useful aid in the cleaning

*Water cleaning methods may not be appropriate to use on some badly deteriorated masonry because water may exacerbate the deterioration, or on gypsum or alabaster which are very soluble in water.

process. (A non-ionic detergent, unlike most household detergents, does not leave a solid, visible residue on the masonry.) Adding a non-ionic detergent and scrubbing with a natural bristle or synthetic bristle brush can facilitate cleaning textured or intricately carved masonry. This should be followed with a final water rinse.

Steam/Hot-Pressurized Water Cleaning. Steam cleaning is actually low-pressure hot water washing because the steam condenses almost immediately upon leaving the hose. This is a gentle and effective method for cleaning stone and particularly for acid-sensitive stones. Steam can be especially useful in removing built-up soiling deposits and dried-up plant materials, such as ivy disks and tendrils. It can also be an efficient means of cleaning carved stone details and, because it does not generate a lot of liquid water, it can sometimes be appropriate to use for cleaning interior masonry (Figs. 8-9).

Potential hazards of water cleaning. Despite the fact that water-based methods are generally the most gentle, even they can be damaging to historic masonry. Before beginning a water cleaning project, it is important to make sure that all mortar joints are sound and that the building is watertight. Otherwise water can seep through the walls to the interior, resulting in rusting metal anchors and stained and ruined plaster.

Some water supplies may contain traces of iron and copper which may cause masonry to discolor. Adding a chelating or complexing agent to the water, such as EDTA (ethylene diamine tetra-acetic acid), which inactivates other metallic ions, as well as softens minerals and water hardness, will help prevent staining on light-colored masonry.

Any cleaning method involving water should never be done in cold weather or if there is any likelihood of frost or freezing because water within the masonry can freeze, causing spalling and cracking. Since a masonry wall may take over a week to dry after cleaning, no water cleaning should be permitted for several days prior to the first average frost date, or even earlier if local forecasts predict cold weather.

Most essential of all, it is important to be aware that using water at too high a pressure, a practice common to "power washing" and "water blasting", is very abrasive and can easily etch marble and other soft stones, as well as some types of brick (Figs. 10-11). In addition, the distance of the nozzle from the masonry surface and the type of nozzle, as well as gallons per minute (gpm), are also important variables in a water cleaning process that can have a significant impact on the outcome of the project. This is why it is imperative that the cleaning be closely monitored to ensure that the cleaning operators do not raise the pressure or bring the nozzle too close to the masonry in an effort to "speed up" the process. The appearance of grains of stone or sand in the cleaning effluent on the ground is an indication that the water pressure may be too high.



Figure 7. Glazed architectural terra cotta often may be cleaned successfully with a low-pressure water wash and hand scrubbing supplemented, if necessary, with a non-ionic detergent. Photo: National Park Service Files.

Chemical Cleaning

Chemical cleaners, generally in the form of proprietary products, are another material frequently used to clean historic masonry. They can remove dirt, as well as paint and other coatings, metallic and plant stains, and graffiti. Chemical cleaners used to remove dirt and soiling include **acids**, **alkalies** and **organic compounds**. Acidic cleaners, of course, should not be used on masonry that is acid sensitive. Paint removers are **alkaline**, based on **organic solvents** or other chemicals.

Chemical Cleaners to Remove Dirt

Both alkaline and acidic cleaning treatments include the use of water. Both cleaners are also likely to contain surfactants (wetting agents), that facilitate the chemical reaction that removes the dirt. Generally, the masonry is wet first for both types of cleaners, then the chemical cleaner is sprayed on at very low pressure or brushed onto the surface. The cleaner is left to dwell on the masonry for an amount of time recommended by the product manufacturer or, preferably, determined by testing, and rinsed off with a low- or moderate-pressure cold, or sometimes hot, water wash. More than one application of the cleaner may be necessary, and it is always a good practice to test the product manufacturer's recommendations concerning dilution rates and dwell times. Because each cleaning situation is unique, dilution rates and dwell times can vary considerably. The masonry surface may be scrubbed lightly with natural or synthetic bristle brushes prior to rinsing. After rinsing, pH strips should be applied to the surface to ensure that the masonry has been neutralized completely.

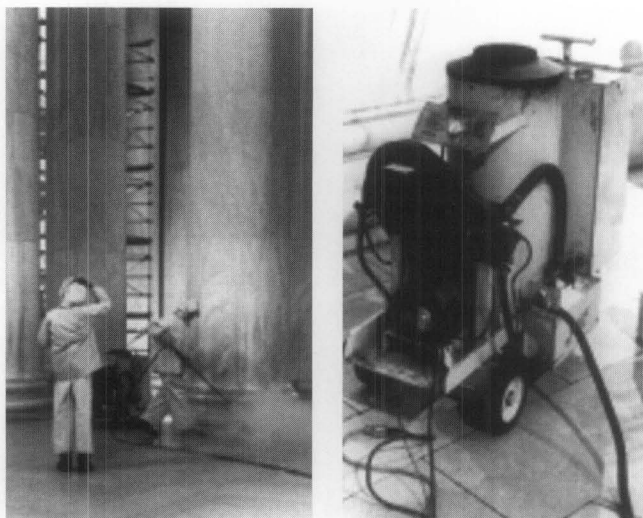


Figure 8. (Left) Low-pressure (under 100 psi) steam cleaning (hot-pressurized water washing), is part of the regular maintenance program at the Jefferson Memorial, Washington, D.C. The white marble interior of this open structure is subject to constant soiling by birds, insects and visitors. (Right) This portable steam cleaner enables prompt cleanup when necessary. Photos: National Park Service Files.

Acidic Cleaners. Acid-based cleaning products may be used on **non-acid sensitive** masonry, which generally includes: granite, most sandstones, slate, unglazed brick and unglazed architectural terra cotta, cast stone and concrete (Fig. 12). Most commercial acidic cleaners are composed primarily of hydrofluoric acid, and often include some phosphoric acid to prevent rust-like stains from developing on the masonry after the cleaning. Acid cleaners are applied to the pre-wet masonry which should be kept wet while the acid is allowed to "work", and then removed with a water wash.

Alkaline Cleaners. Alkaline cleaners should be used on **acid-sensitive** masonry, including: limestone, polished and unpolished marble, calcareous sandstone, glazed brick and glazed architectural terra cotta, and polished granite. (Alkaline cleaners may also be used sometimes on masonry materials that are not acid sensitive—after testing, of course

—but they may not be as effective as they are on acid-sensitive masonry.) Alkaline cleaning products consist primarily of two ingredients: a non-ionic detergent or surfactant; and an alkali, such as potassium hydroxide or ammonium hydroxide. Like acidic cleaners, alkaline products are usually applied to pre-wet masonry, allowed to dwell, and then rinsed off with water. (Longer dwell times may be necessary with alkaline cleaners than with acidic cleaners.) Two additional steps are required to remove alkaline cleaners after the initial rinse. First the masonry is given a slightly acidic wash—often with acetic acid—to neutralize it, and then it is rinsed again with water.

Chemical Cleaners to Remove Paint and Other Coatings, Stains and Graffiti

Removing paint and some other coatings, stains and graffiti can best be accomplished with alkaline paint removers, organic solvent paint removers, or other cleaning compounds. The removal of layers of paint from a masonry surface usually involves applying the remover either by brush, roller or spraying, followed by a thorough water wash. As with any chemical cleaning, the manufacturer's recommendations regarding application procedures should always be tested before beginning work.

Alkaline Paint Removers. These are usually of much the same composition as other alkaline cleaners, containing potassium or ammonium hydroxide, or trisodium phosphate. They are used to remove oil, latex and acrylic paints, and are effective for removing multiple layers of paint. Alkaline cleaners may also remove some acrylic, water-repellent coatings. As with other alkaline cleaners, both an acidic neutralizing wash and a final water rinse are generally required following the use of alkaline paint removers.

Organic Solvent Paint Removers. The formulation of organic solvent paint removers varies and may include a combination of solvents, including methylene chloride, methanol, acetone, xylene and toluene.

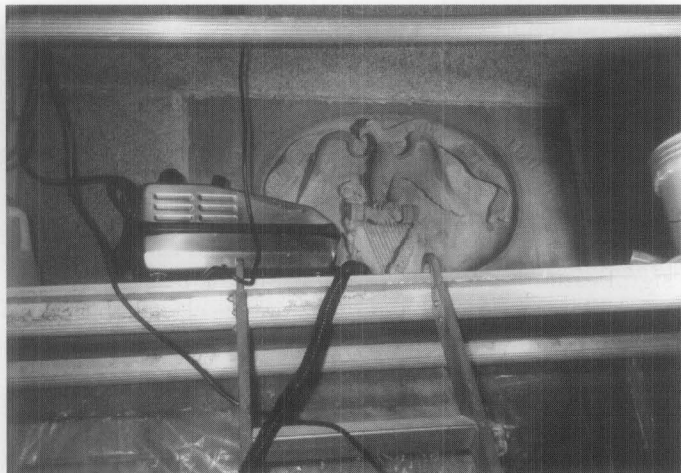


Figure 9. (Left) This small steam cleaner—the size of a vacuum cleaner—offers a very controlled and gentle means of cleaning limited, or hard-to-reach areas or carved stone details. (Right) It is particularly useful for interiors where it is important to keep moisture to a minimum, such as inside the Washington Monument, Washington, D.C., where it was used to clean the commemorative stones. Photos: Audrey T. Tepper.



Figure 10. High-pressure water washing too close to the surface has abraded and, consequently, marred the limestone on this early-20th century building.

Other Paint Removers and Cleaners. Other cleaning compounds that can be used to remove paint and some painted graffiti from historic masonry include paint removers based on N-methyl-2-pyrrolidone (NMP), or on petroleum-based compounds. Removing stains, whether they are industrial (smoke, soot, grease or tar), metallic (iron or copper), or biological (plant and fungal) in origin, depends on carefully matching the type of remover to the type of stain (Fig. 13). Successful removal of stains from historic masonry often requires the application of a number of different removers before the right one is found. The removal of layers of paint from a masonry surface is usually accomplished by applying the remover either by brush, roller or spraying, followed by a thorough water wash (Fig. 14).

Potential hazards of chemical cleaning. Since most chemical cleaning methods involve water, they have many of the potential problems of plain water cleaning. Like water methods, they should not be used in cold weather because of the possibility of freezing. Chemical cleaning should never be undertaken in temperatures below 40 degrees F (4 degrees C), and generally not below 50 degrees F. In addition, many chemical cleaners simply do not work in cold temperatures. Both acidic and alkaline cleaners can be dangerous to cleaning operators and, clearly, there are environmental concerns associated with the use of chemical cleaners.

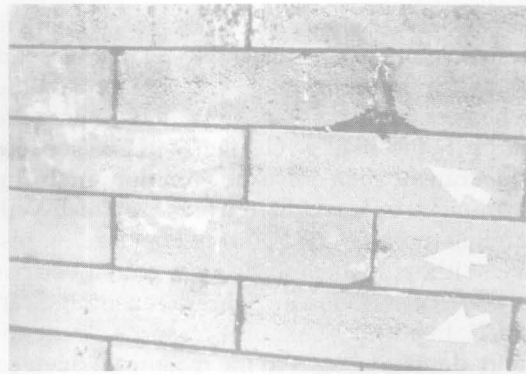


Figure 11. Rinsing with high-pressure water following chemical cleaning has left a horizontal line of abrasion across the bricks on this late-19th century row house.

If not carefully chosen, chemical cleaners can react adversely with many types of masonry. Obviously, acidic cleaners should not be used on acid-sensitive materials; however, it is not always clear exactly what the composition is of any stone or other masonry material. For this reason, testing the cleaner on an inconspicuous spot on the building is always necessary. While certain acid-based cleaners may be appropriate if used as directed on a particular type of masonry, if left too long or if not adequately rinsed from the masonry they can have a negative effect. For example, hydrofluoric acid can etch masonry leaving a hazy residue (whitish deposits of silica or calcium fluoride salts) on the surface. While this efflorescence may usually be removed by a second cleaning—although it is likely to be expensive and time-consuming—hydrofluoric acid can also leave calcium fluoride salts or a colloidal silica deposit on masonry which may be impossible to remove (Fig. 15). Other acids, particularly hydrochloric (muriatic) acid, which is very powerful, should not be used on historic masonry, because it can dissolve lime-based mortar, damage brick and some stones, and leave chloride deposits on the masonry.



Figure 12. A mild acidic cleaning agent is being used to clean this heavily soiled brick and granite building. Additional applications of the cleaner and hand-scrubbing, and even poulticing, may be necessary to remove the dark stains on the granite arches below. Photo: Sharon C. Park, FAIA.

Alkaline cleaners can stain sandstones that contain a ferrous compound. Before using an alkaline cleaner on sandstone it is always important to test it, since it may be difficult to know whether a particular sandstone may contain a ferrous compound. Some alkaline cleaners, such as **sodium hydroxide (caustic soda or lye)** and **ammonium bifluoride**, can also damage or leave disfiguring brownish-yellow stains and, in most cases, should not be used on historic masonry. Although alkaline cleaners will not etch a masonry surface as acids can, they are caustic and can burn the surface. In addition, alkaline cleaners can deposit potentially damaging salts in the masonry which can be difficult to rinse thoroughly.

Abrasive and Mechanical Cleaning

Generally, abrasive cleaning methods are not appropriate for use on historic masonry buildings. Abrasive cleaning methods are just that—abrasive. Grit blasters, grinders, and sanding discs all operate by *abrading* the dirt or paint off the surface of the masonry, rather than *reacting* with the dirt and the masonry which is how water and chemical methods work. Since the abrasives do not differentiate between the dirt and the masonry, they can also remove the outer surface of the masonry at the same time, and result in permanently damaging the masonry. Brick, architectural terra cotta, soft stone, detailed carvings, and polished surfaces are especially susceptible to physical and aesthetic damage by abrasive methods. Brick and architectural terra cotta are fired products which have a smooth, glazed surface which can be removed by abrasive blasting or grinding (Figs. 18-19). Abrasively-cleaned masonry is damaged aesthetically as well as physically, and it has a rough surface which tends to hold dirt and the roughness will make future cleaning more difficult. Abrasive cleaning processes can also increase the likelihood of subsurface cracking of the masonry. Abrasion of carved details causes a rounding of sharp corners and other loss of delicate features, while abrasion of polished surfaces removes the polished finish of stone.

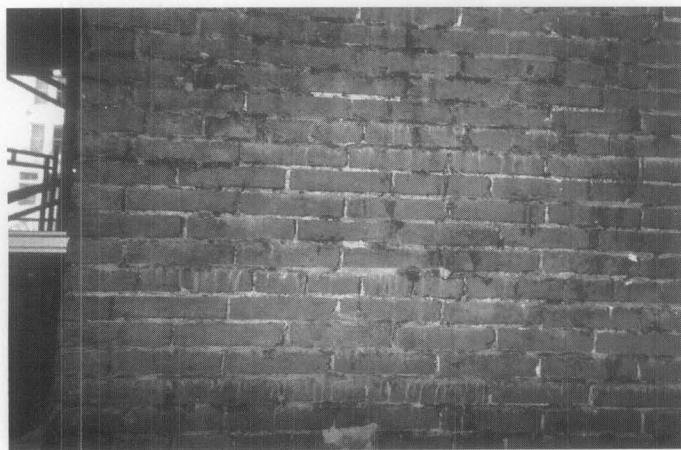


Figure 13. Sometimes it may be preferable to paint over a thick asphaltic coating rather than try to remove it, because it can be difficult to remove completely. However, in this case, many layers of asphaltic coating were removed through multiple applications of a heavy duty chemical cleaner. Each application of the cleaner was left to dwell following the manufacturer's recommendations, and then rinsed thoroughly. (As much as possible of the asphalt was first removed with wooden scrapers.) Although not all the asphalt was removed, this was determined to be an acceptable level of cleanliness for the project.



Figure 14. Chemical removal of paint from this brick building has revealed that the cornice and window hoods are metal rather than masonry.

Mortar joints, especially those with lime mortar, also can be eroded by abrasive or mechanical cleaning. In some cases, the damage may be visual, such as loss of joint detail or increased joint shadows. As mortar joints constitute a significant portion of the masonry surface (up to 20 per cent in a brick wall), this can result in the loss of a considerable amount of the historic fabric. Erosion of the mortar joints may also permit increased water penetration, which will likely necessitate repointing.



Figure 15. The whitish deposits left on the brick by a chemical paint remover may have resulted from inadequate rinsing or from the chemical being left on the surface too long and may be impossible to remove.

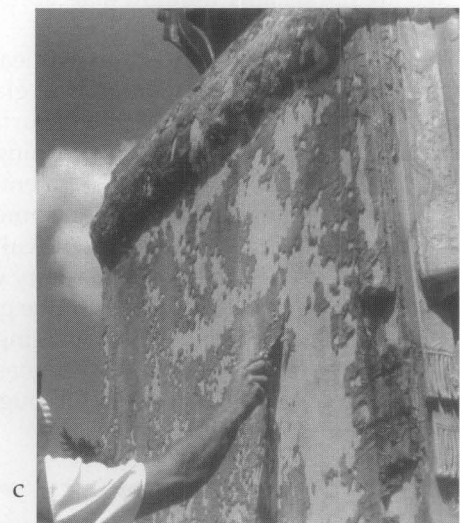
Poulticing to Remove Stains and Graffiti



a



b



c



d

Figure 16. (a) The limestone base was heavily stained by runoff from the bronze statue above. (b) A poultice consisting of copper stain remover and ammonia mixed with fuller's earth was applied to the stone base and covered with plastic sheeting to keep it from drying out too quickly. (c) As the poultice dried, it pulled the stain out of the stone. (d) The poultice residue was removed carefully from the stone surface with wooden scrapers and the stone was rinsed with water. Photos: John Dugger.

Graffiti and stains, which have penetrated into the masonry, often are best removed by using a poultice. A poultice consists of an absorbent material or clay powder (such as kaolin or fuller's earth, or even shredded paper or paper towels), mixed with a liquid (solvent or other remover) to form a paste which is applied to the stain (Figs. 16-17). As it dries, the paste absorbs the staining material so that it is not redeposited on the masonry surface. Some commercial cleaning products and paint removers are specially formulated as a paste or gel that will cling to a vertical surface and remain moist for a longer period of time in order to prolong the action of the chemical on the stain. Pre-mixed poultices are also available as a paste or in powder form needing only the addition of the appropriate liquid. The masonry must be pre-wet before applying an alkaline cleaning agent, but not when using a solvent. Once the stain has been removed, the masonry must be rinsed thoroughly.



Figure 17. A poultice is being used to remove salts from the brownstone statuary on the facade of this late-19th century stone church. Photo: National Park Service Files.



Figure 18. The glazed bricks in the center of the pier were covered by a signboard that protected them being damaged by the sandblasting which removed the glaze from the surrounding bricks.

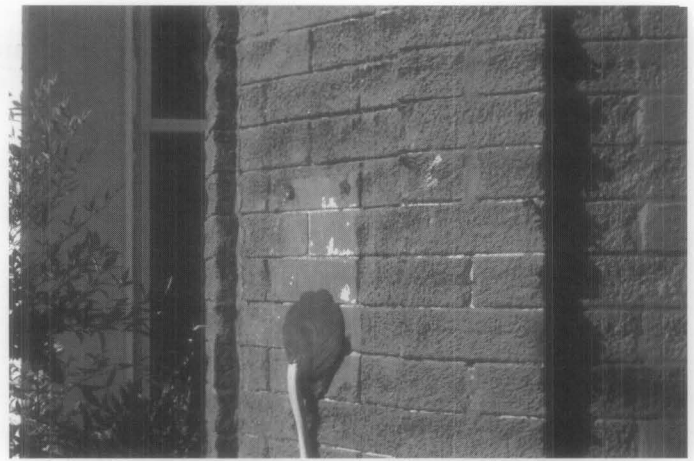


Figure 19. A comparison of undamaged bricks surrounding the electrical conduit with the rest of the brick facade emphasizes the severity of the erosion caused by sandblasting.

Abrasive Blasting. Blasting with abrasive grit or another abrasive material is the most frequently used abrasive method. *Sandblasting* is most commonly associated with abrasive cleaning. Finely ground silica or glass powder, glass beads, ground garnet, powdered walnut and other ground nut shells, grain hulls, aluminum oxide, plastic particles and even tiny pieces of sponge, are just a few of the other materials that have also been used for abrasive cleaning. Although abrasive blasting is not an appropriate method of cleaning historic masonry, it can be safely used to clean some materials. Finely-powdered walnut shells are commonly used for cleaning monumental bronze sculpture, and skilled conservators clean delicate museum objects and finely detailed, carved stone features with very small, micro-abrasive units using aluminum oxide.

A number of current approaches to abrasive blasting rely on materials that are not usually thought of as abrasive, and not as commonly associated with traditional abrasive grit cleaning. Some patented abrasive cleaning processes—one dry, one wet—use finely-ground glass powder intended to “erase” or remove dirt and surface soiling only, but not paint or stains (Fig. 20). Cleaning with baking soda (sodium bicarbonate) is another patented process. Baking soda blasting is being used in some communities as a means of quick graffiti removal. However, it should not be used on historic masonry which it can easily abrade and can permanently “etch” the graffiti into the stone; it can also leave potentially damaging salts in the stone which cannot be removed. Most of these abrasive grits may be used either dry or wet, although dry grit tends to be used more frequently.

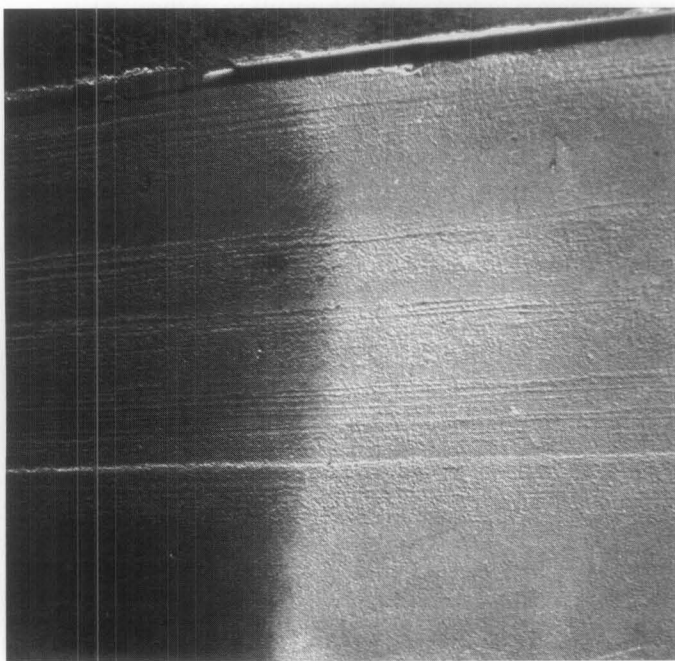


Figure 20. (Left) A comparison of the limestone surface of a 1920s office building before and after “cleaning” with a proprietary abrasive process using fine glass powder clearly shows the effectiveness of this method. But this is an abrasive technique and it has “cleaned” by removing part of the masonry surface with the dirt. Because it is abrasive, it is generally not recommended for large-scale cleaning of historic masonry, although it may be suitable to use in certain, very limited cases under controlled circumstances. (Right) A vacuum chamber where the used glass powder is collected for environmentally safe disposal is a unique feature of this particular process. The specially-trained operators in the chamber wear protective clothing, masks and breathing equipment. Photos: Tom Keohan.

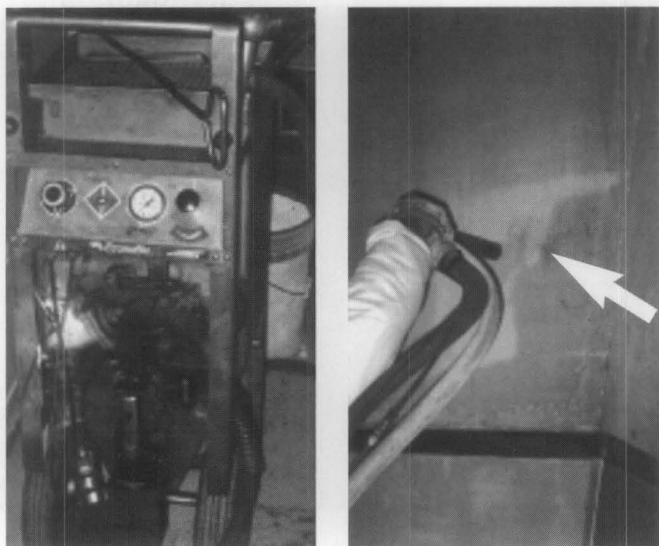


Figure 21. Low-pressure blasting with ice pellets or ice crystals (left) is an abrasive cleaning method that is sometimes recommended for use on interior masonry because it does not involve large amounts of water. However, like other abrasive materials, ice crystals "clean" by removing a portion of the masonry surface with the dirt, and may not remove some stains that have penetrated into the masonry without causing further abrasion (right). Photos: Audrey T. Tepper.

Ice particles, or pelletized dry ice (carbon dioxide or CO_2), are another medium used as an abrasive cleaner (Fig. 21). This is also too abrasive to be used on most historic masonry, but it may have practical application for removing mastics or asphaltic coatings from some substrates.

Some of these processes are promoted as being more environmentally safe and not damaging to historic masonry buildings. However, it must be remembered that they are abrasive and that they "clean" by removing a small portion of the masonry surface, even though it may be only a minuscule portion. The fact that they are essentially abrasive treatments must always be taken into consideration when planning a masonry cleaning project. *In general, abrasive methods should not be used to clean historic masonry buildings.* In some, very limited instances, highly-controlled, gentle abrasive cleaning may be appropriate on selected, hard-to-clean areas of a historic masonry building if carried out under the watchful supervision of a professional conservator. But, abrasive cleaning should never be used on an entire building.

Grinders and Sanding Disks. Grinding the masonry surface with mechanical grinders and sanding disks is another means of abrasive cleaning that should not be used on historic masonry. Like abrasive blasting, grinders and disks do not really clean masonry but instead grind away and abrasively remove and, thus, damage the masonry surface itself rather than remove just the soiling material.

Planning A Cleaning Project

Once the masonry and soiling material or paint have been identified, and the condition of the masonry has been evaluated, planning for the cleaning project can begin.

Testing cleaning methods. In order to determine the *gentlest means possible*, several cleaning methods or materials may have to be tested prior to selecting the best one to use on the building. Testing should always begin with the gentlest and least invasive method proceeding gradually, if necessary, to more complicated methods, or a combination of methods. All too often simple methods, such as low-pressure water wash, are not even considered, yet they frequently are effective, safe, and not expensive. Water of slightly higher pressure or with a non-ionic detergent additive also may be effective. It is worth repeating that these methods should always be tested prior to considering harsher methods; they are safer for the building and the environment, often safer for the applicator, and relatively inexpensive.

The level of cleanliness desired also should be determined prior to selection of a cleaning method. Obviously, the intent of cleaning is to remove most of the dirt, soiling material, stains, paint or other coating. A "brand new" appearance, however, may be inappropriate for an older building, and may require an overly harsh cleaning method to be achieved. When undertaking a cleaning project, it is important to be aware that some stains simply may not be removable. It may be wise, therefore, to agree upon a slightly lower level of cleanliness that will serve as the standard for the cleaning project. The precise amount of residual dirt considered acceptable may depend on the type of masonry, the type of soiling and difficulty of total removal, and local environmental conditions.

Cleaning tests should be carried out in an area of sufficient size to give a true indication of their effectiveness. It is preferable to conduct the test in an inconspicuous location on the building so that it will not be obvious if the test is not successful. A test area may be quite small to begin, sometimes as small as six square inches, and gradually may be increased in size as the most appropriate methods and cleaning agents are determined. Eventually the test area may be expanded to a square yard or more, and it should include several masonry units and mortar joints (Fig. 22). It should be remembered that a single building may have several types of masonry and that even similar materials may have different surface finishes. Each material and different finish should be tested separately. Cleaning tests should be evaluated only after the masonry has dried completely. *The results of the tests may indicate that several methods of cleaning should be used on a single building.*

When feasible, test areas should be allowed to weather for an extended period of time prior to final evaluation. A waiting period of a full year would be ideal in order to expose the test patch to a full range of seasons. If this is not possible, the test patch should weather for at least a month or two. For any building which is considered historically important, the delay is insignificant compared to the potential damage and disfigurement which may result from using an incompletely tested method. *The successfully cleaned test patch should be protected as it will serve as a standard against which the entire cleaning project will be measured.*

Environmental considerations. The potential effect of any method proposed for cleaning historic masonry should be evaluated carefully. Chemical cleaners and paint removers may damage trees, shrubs, grass, and plants. A plan must be provided for environmentally safe removal and disposal of the cleaning materials and the rinsing effluent before beginning the cleaning project. Authorities from the local regulatory agency—usually under the jurisdiction of the federal or state Environmental Protection Agency (EPA)—should be consulted prior to beginning a cleaning project, especially if it involves anything more than plain water washing. This advance planning will ensure that the cleaning effluent or run-off, which is the combination of the cleaning agent and the substance removed from the masonry, is handled and disposed of in an environmentally sound and legal manner. Some alkaline and acidic cleaners can be neutralized so that they can be safely discharged into storm sewers. However, most solvent-based cleaners cannot be neutralized and are categorized as pollutants, and must be disposed of by a licensed transport, storage and disposal facility. Thus, it is always advisable to consult with the appropriate agencies before starting to clean to ensure that the project progresses smoothly and is not interrupted by a stop-work order because a required permit was not obtained in advance.

Vinyl guttering or polyethylene-lined troughs placed around the perimeter of the base of the building can serve to catch chemical cleaning waste as it is rinsed off the building. This will reduce the amount of chemicals entering and polluting the soil, and also will keep the cleaning waste contained until it can be removed safely. Some patented cleaning systems have developed special equipment to facilitate the containment and later disposal of cleaning waste.

Concern over the release of volatile organic compounds (VOCs) into the air has resulted in the manufacture of new, more environmentally responsible cleaners and paint removers, while some materials traditionally used in cleaning may no longer be available for these same reasons. Other health and safety concerns have created additional cleaning challenges, such as lead paint removal, which is likely to require special removal and disposal techniques.

Cleaning can also cause damage to non-masonry materials on a building, including glass, metal and wood. Thus, it is usually necessary to cover windows and doors, and other features that may be vulnerable to chemical cleaners. They should be covered with plastic or polyethylene, or a masking agent that is applied as a liquid which dries to form a thin protective film on glass, and is easily peeled off after the cleaning is finished. Wind drift, for example, can also damage other property by carrying cleaning chemicals onto nearby automobiles, resulting in etching of the glass or spotting of the paint finish. Similarly, airborne dust can enter surrounding buildings, and excess water can collect in nearby yards and basements.

Safety considerations. Possible health dangers of each method selected for the cleaning project must be considered before selecting a cleaning method to avoid harm to the

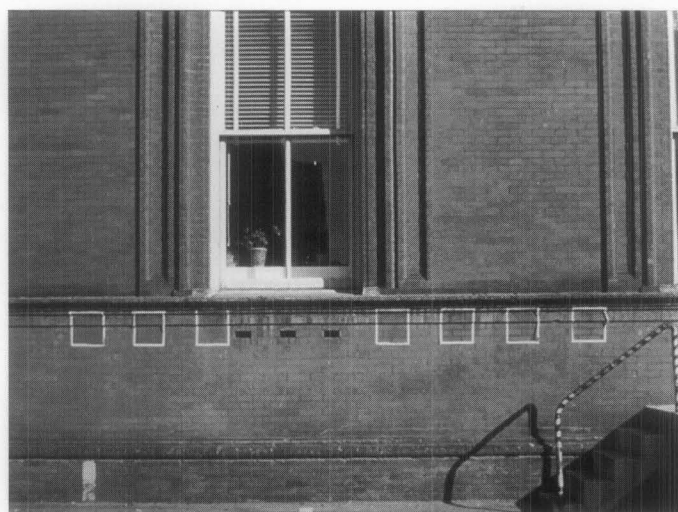


Figure 22. Cleaning test areas may be quite small at first and gradually increase in size as testing determines the "gentlest means possible".
Photo: Frances Gale.

cleaning applicators, and the necessary precautions must be taken. The precautions listed in Material Safety Data Sheets (MSDS) that are provided with chemical products should always be followed. Protective clothing, respirators, hearing and face shields, and gloves must be provided to workers to be worn at all times. Acidic and alkaline chemical cleaners in both liquid and vapor forms can also cause serious injury to passers-by (Fig. 23). It may be necessary to schedule cleaning at night or weekends if the building is located in a busy urban area to reduce the potential danger of chemical overspray to pedestrians. Cleaning during non-business hours will allow HVAC systems to be turned off and vents to be covered to prevent dangerous chemical fumes from entering the building which will also ensure the safety of the building's occupants. Abrasive and mechanical methods produce dust which can pose a serious health hazard, particularly if the abrasive or the masonry contains silica.

Water-Repellent Coatings and Waterproof Coatings

To begin with, it is important to understand that waterproof coatings and water-repellent coatings are not the same. Although these terms are frequently interchanged and commonly confused with one another, they are completely different materials. **Water-repellent coatings**—often referred to incorrectly as "sealers", but which do not or should not seal—are intended to keep liquid water from penetrating the surface but to allow water vapor to enter and leave, or pass through, the surface of the masonry (Fig. 24). Water-repellent coatings are generally *transparent*, or clear, although once applied some may darken or discolor certain types of masonry while others may give it a glossy or shiny appearance. **Waterproof coatings** seal the surface from liquid water and from water vapor. They are usually *opaque*, or pigmented, and include bituminous coatings and some elastomeric paints and coatings.

Water-Repellent Coatings

Water-repellent coatings are formulated to be vapor permeable, or "breathable". They do not seal the surface completely to water vapor so it can enter the masonry wall as well as leave the wall. While the first water-repellent coatings to be developed were primarily acrylic or silicone resins in organic solvents, now most water-repellent coatings are water-based and formulated from modified siloxanes, silanes and other alkoxysilanes, or metallic stearates. While some of these products are shipped from the factory ready to use, other waterborne water repellents must be diluted at the job site. Unlike earlier water-repellent coatings which tended to form a "film" on the masonry surface, modern water-repellent coatings actually penetrate into the masonry substrate slightly and, generally, are almost invisible if properly applied to the masonry. They are also more vapor permeable than the old coatings, yet they still reduce the vapor permeability of the masonry. Once inside the wall, water vapor can condense at cold spots producing liquid water which, unlike water vapor, cannot escape through a water-repellent coating. The liquid water within the wall, whether from condensation, leaking gutters, or other sources, can cause considerable damage.

Water-repellent coatings are not consolidants. Although modern water repellents may penetrate slightly beneath the masonry surface, instead of just "sitting" on top of it, they do not perform the same function as a consolidant which is to "consolidate" and replace lost binder to strengthen deteriorating masonry. Even after many years of laboratory study and testing few consolidants have proven very effective. The composition of fired products such as brick and architectural terra cotta, as well as many types of building stone, does not lend itself to consolidation.

Some modern water-repellent coatings which contain a binder intended to replace the natural binders in stone that have been lost through weathering and natural erosion are described in product literature as both a water repellent and a consolidant. The fact that newer water-repellent coatings penetrate beneath the masonry surface instead of just forming a layer on top of the surface may indeed convey at least some consolidating properties to certain stones. However, a water-repellent coating cannot be considered a consolidant. In some instances, a water-repellent or "preservative" coating, if applied to already damaged or spalling stone, may form a surface crust which, if it fails, may exacerbate the deterioration by pulling off even more of the stone (Fig. 25).

Is a Water-Repellent Treatment Necessary?

Water-repellent coatings are frequently applied to historic masonry buildings for the wrong reason. They also are often applied without an understanding of what they are and what they are intended to do. And these coatings can be very difficult, if not impossible, to remove from the masonry if they fail or become discolored. Most importantly, the application of water-repellent coatings to historic masonry is usually unnecessary.



Figure 23. A tarpaulin protects and shields pedestrians from potentially harmful spray while chemical cleaning is underway on the granite exterior of the U.S. Treasury Building, Washington, D.C.

Most historic masonry buildings, unless they are painted, have survived for decades without a water-repellent coating and, thus, probably do not need one now. Water penetration to the interior of a masonry building is seldom due to porous masonry, but results from poor or deferred maintenance. Leaking roofs, clogged or deteriorated gutters and downspouts, missing mortar, or cracks and open joints around door and window openings are almost always the cause of moisture-related problems in a historic masonry building. **If historic masonry buildings are kept watertight and in good repair, water-repellent coatings should not be necessary.**

Rising damp (capillary moisture pulled up from the ground), or condensation can also be a source of excess moisture in masonry buildings. A water-repellent coating will not solve this problem either and, in fact, may be likely to exacerbate it. Furthermore, a water-repellent coating should never be applied to a damp wall. Moisture in the wall would reduce the ability of a coating to adhere to the masonry and to penetrate below the surface. But, if it did adhere, it would hold the moisture inside the masonry because, although a water-repellent coating is permeable to water vapor, liquid water cannot pass through it. In the case of rising damp, a coating may force the moisture to go even higher in the wall because it can slow down evaporation, and thereby retain the moisture in the wall.

Excessive moisture in masonry walls may carry waterborne soluble salts from the masonry units themselves or from the mortar through the walls. If the water is permitted to come to the surface, the salts may appear on the masonry surface as efflorescence (a whitish powder) upon evaporation. However, the salts can be potentially dangerous if they remain in the masonry and crystallize



Figure 24. Although the application of a water-repellent coating was probably not needed on either of these buildings, the coating on the brick building (above), is not visible and has not changed the character of the brick. But the coating on the brick column (below), has a high gloss that is incompatible with the historic character of the masonry.



beneath the surface as subflorescence. Subflorescence eventually may cause the surface of the masonry to spall, particularly if a water-repellent coating has been applied which tends to reduce the flow of moisture out from the subsurface of the masonry. Although many of the newer water-repellent products are more breathable than their predecessors, they can be especially damaging if applied to masonry that contains salts, because they limit the flow of moisture through masonry.

When a Water-Repellent Coating May be Appropriate

There are some instances when a water-repellent coating may be considered appropriate to use on a historic masonry building. Soft, incompletely fired brick from the 18th- and early-19th centuries may have become so porous that paint or some type of coating is needed to protect it from further deterioration or dissolution. When a masonry building has been neglected for a long period of time, necessary repairs may be required in order to make it watertight. If, following a reasonable period of time after the building has been made watertight and has dried out completely, moisture appears actually to be penetrating through the repointed and repaired masonry walls, then the application of a water-repellent coating may be considered *in selected areas only*. This decision should be made in consultation with an architectural conservator. And, if such a treatment is undertaken, it should not be applied to the entire exterior of the building.

Anti-graffiti or barrier coatings are another type of clear coating—although barrier coatings can also be pigmented—that may be applied to exterior masonry, but they are not formulated primarily as water repellents. The purpose of these coatings is to make it harder for graffiti to stick to a masonry surface and, thus, easier to clean. But, like water-repellent coatings, in most cases the application of anti-graffiti coatings is generally not recommended for historic masonry buildings. These coatings are often quite shiny which can greatly alter the appearance of a historic masonry surface, and they are not always effective (Fig. 26). Generally, other ways of discouraging graffiti, such as improved lighting, can be more effective than a coating. However, the application of anti-graffiti coatings may be appropriate in some instances on vulnerable areas of historic masonry buildings which are frequent targets of graffiti that are located in out-of-the-way places where constant surveillance is not possible.

Some water-repellent coatings are recommended by product manufacturers as a means of keeping dirt and pollutants or biological growth from collecting on the surface of masonry buildings and, thus, reducing the need for frequent cleaning. While this at times may be true, in some cases a coating may actually retain dirt more than uncoated masonry. Generally, the application of a water-repellent coating is not recommended on a historic masonry building as a means of preventing biological growth. Some water-repellent coatings may actually encourage biological growth on a masonry wall. Biological growth on masonry buildings has traditionally been kept at bay through regularly-scheduled cleaning as part of a maintenance plan. Simple cleaning of the masonry with low-pressure water using a natural- or synthetic-bristled scrub brush can be very effective if done on a regular basis. Commercial products are also available which can be sprayed on masonry to remove biological growth.

In most instances, a water-repellent coating is not necessary if a building is watertight. The application of a water-repellent coating is not a recommended treatment for historic masonry buildings unless there is a specific



Figure 25. The clear coating applied to this limestone molding has failed and is taking off some of the stone surface as it peels. Photo: Frances Gale.

problem which it may help solve. If the problem occurs on only part of the building, it is best to treat only that area rather than an entire building. Extreme exposures such as parapets, for example, or portions of the building subject to driving rain can be treated more effectively and less expensively than the entire building. Water-repellent coatings are not permanent and must be reapplied

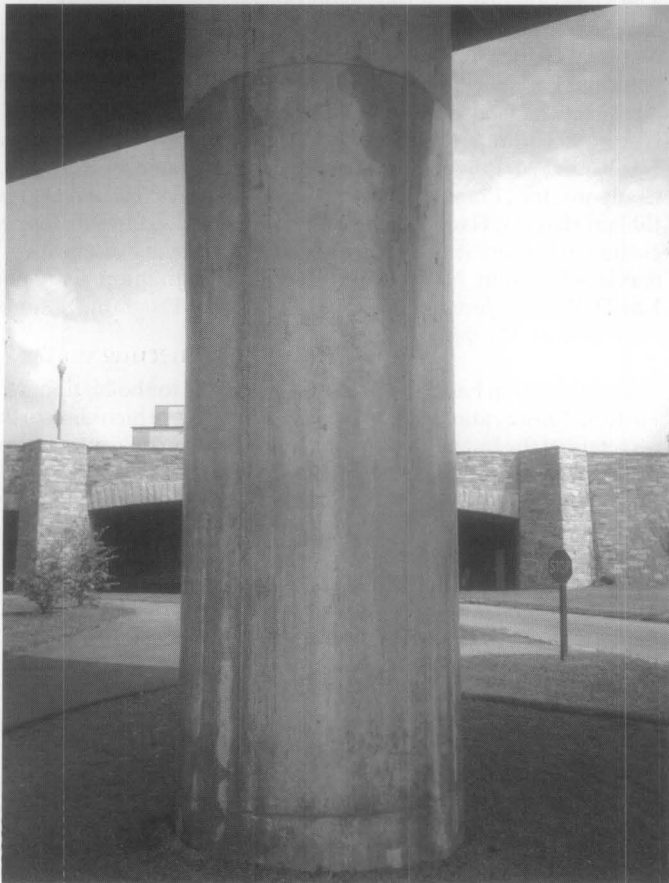


Figure 26. The anti-graffiti or barrier coating on this column is very shiny and would not be appropriate to use on a historic masonry building. The coating has discolored as it has aged and whitish streaks reveal areas of bare concrete where the coating was incompletely applied.

periodically although, if they are truly invisible, it can be difficult to know when they are no longer providing the intended protection.

Testing a water-repellent coating by applying it in one small area may not be helpful in determining its suitability for the building because a limited test area does not allow an adequate evaluation of such a treatment. Since water may enter and leave through the surrounding untreated areas, there is no way to tell if the coated test area is "breathable." But trying a coating in a small area may help to determine whether the coating is visible on the surface or if it will otherwise change the appearance of the masonry.

Waterproof Coatings

In theory, waterproof coatings usually do not cause problems as long as they exclude all water from the masonry. If water does enter the wall from the ground or from the inside of a building, the coating can intensify the damage because the water will not be able to escape. During cold weather this water in the wall can freeze causing serious mechanical disruption, such as spalling.

In addition, the water eventually will get out by the path of least resistance. If this path is toward the interior, damage to interior finishes can result; if it is toward the exterior, it can lead to damage to the masonry caused by built-up water pressure (Fig. 27).

In most instances, waterproof coatings should not be applied to historic masonry. The possible exception to this might be the application of a waterproof coating to below-grade exterior foundation walls as a last resort to stop water infiltration on interior basement walls. **Generally, however, waterproof coatings, which include elastomeric paints, should almost never be applied above grade to historic masonry buildings.**



Figure 27. Instead of correcting the roof drainage problems, an elastomeric coating was applied to the already saturated limestone cornice. An elastomeric coating holds moisture in the masonry because it does not "breathe" and does not allow liquid moisture to escape. If the water pressure builds up sufficiently it can cause the coating to break and pop off as shown in this example, often pulling pieces of the masonry with it. Photo: National Park Service Files.

Summary

A well-planned cleaning project is an essential step in preserving, rehabilitating or restoring a historic masonry building. Proper cleaning methods and coating treatments, when determined necessary for the preservation of the masonry, can enhance the aesthetic character as well as the structural stability of a historic building. Removing years of accumulated dirt, pollutant crusts, stains, graffiti or paint, if done with appropriate caution, can extend the life and longevity of the historic resource. Cleaning that is carelessly or insensitively prescribed or carried out by inexperienced workers can have the opposite of the intended effect. It may scar the masonry permanently, and may actually result in hastening deterioration by introducing harmful residual chemicals and salts into the masonry or causing surface loss. Using the wrong cleaning method or using the right method incorrectly, applying the wrong kind of coating or applying a coating that is not needed can result in serious damage, both physically and aesthetically, to a historic masonry building. Cleaning a historic masonry building should always be done using the *gentlest means possible* that will clean, but not damage the building. It should always be taken into consideration before applying a water-repellent coating or a waterproof coating to a historic masonry building whether it is really necessary and whether it is in the best interest of preserving the building.

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Acknowledgments

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Front Cover: Chemical cleaning of the brick and architectural terra cotta frieze on the 1880s Pension Building, Washington, D.C. (now the National Building Museum), is shown here in progress. Photo: Christina Henry.

Photographs used to illustrate this Brief were taken by Anne Grimmer unless otherwise credited.

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Keeping it Clean

Removing Exterior Dirt, Paint, Stains and Graffiti from Historic Masonry Buildings

Anne E. Grimmer



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Preface

Despite the inherent hazards, cleaning historic masonry, which includes stone, brick, architectural terra cotta, and cast stone, stucco and concrete, is one of the most common—and most visible—undertakings when rehabilitating or restoring historic masonry structures. Yet basic information and good technical advice may be hard to find. As a result, those responsible for the care of historic buildings frequently must rely upon the recommendations of a cleaning contractor or a cleaning product manufacturer who may not be completely objective, or familiar with all the cleaning options currently available. The cleaning of historic masonry should thus always be carried out under the supervision and guidance of a preservation or conservation specialist.

The purpose of this technical report is to provide information on removing dirt, stains, paint and related coatings, graffiti, and other disfiguring or potentially harmful substances from exterior masonry. First, however, there is a general discussion on all aspects of planning and carrying out a cleaning project, including anticipating potential problems; correctly identifying what is to be removed; identifying all building materials to be cleaned

as well as other materials that might be affected by cleaning; and testing cleaning procedures to ensure the most successful project. The report also includes warnings about using certain techniques on specific building materials, as well as possible dangers to project personnel and the building's environment.

Unless otherwise credited, photographs were taken by the author.

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Part I

What to Consider Before Cleaning

Reasons for Cleaning

There are two primary reasons for cleaning a historic masonry building: 1) to improve the appearance of the structure; and 2) to remove dirt, stains, coatings, efflorescence (salts) and pollutants that may be causing deterioration of the masonry. Generally, the two are intertwined, but the most common motivation for cleaning masonry is the desire for cosmetic improvement. It is easy to understand this rationale, especially considering the positive visual impact of a clean building.

Cosmetic Improvement

A most important factor to consider before cleaning a historic masonry building is its patina—the color and surface texture, or

the appearance which only time can impart. Patina usually includes a combination of surface stains, deposits, discoloration, and changes to the surface texture that may result from atmospheric dissolution and erosion. Naturally, patina includes a certain amount of dirt. As long as it does not contribute to, or conceal deterioration, patina is indeed part of the character of a historic building, and careful consideration should be given to its preservation. Determining when patina may be harmful or disfiguring must be done on a building-by-building basis, and will depend on the *type of masonry, the type and degree of soiling, and how much it might be obscuring damage to the masonry units themselves or to the mortar joints*. Careful removal of dirt and pollutant crusts can restore many aspects of the original appearance of the masonry—the color, texture and carved detailing that might have been hidden for years.

The unwelcome presence of graffiti usually triggers an urgent need for cosmetic improvement. An owner or building manager would likely want to remove graffiti as quickly as possible after it appears. Prompt removal is, in itself, a logical approach to the problem because it tends to discourage the incidence of more graffiti. On the other hand, if cleaning is undertaken too hastily, the results may be less than satisfactory (figure 1).

Removing paint from masonry, particularly from brick, is another common “cleaning” treatment, although it may not always be an appropriate or successful treatment for the building. Often, it may be preferable to retain the paint. Painted brick buildings were very popular throughout several historic periods. Many, in fact, were painted immediately after construction. Decorative treatments, such as the penciling of mortar joints, should be carefully examined; they may be original or may have acquired significance over the years. Paint may also have been applied as a protective coating, usually on

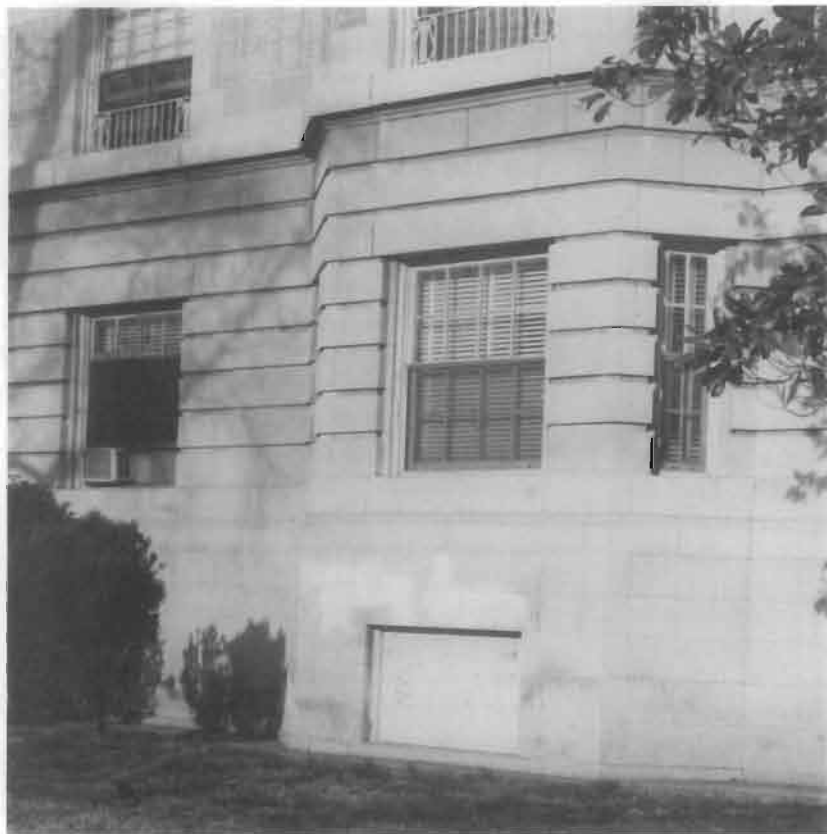


Figure 1. When an inappropriate chemical cleaner was used to remove graffiti, it resulted in permanently bleaching the limestone foundation, and left a mark as unsightly as the graffiti.

some of the more porous types of brick and sandstone; or applied to camouflage alterations or incompatible masonry repairs. All of these factors should be taken into consideration before paint removal is begun. If all nondamaging methods of paint removal have been tried and proven ineffective, it may be best to leave the masonry painted. Or, if the paint is in poor condition, the best approach may be to remove only the loose and peeling paint to a sound surface, and then repaint.

Slowing the Processes of Deterioration

The strongest practical argument in support of masonry cleaning is that it may slow the processes of deterioration and decay. Heavy layers of dirt not only interfere with natural weathering and washing patterns, but also obscure deterioration (figure 2). Cleaning is often necessary to help the architect or building conservator detect problems, and correctly interpret them, in order to take corrective measures, and to prepare a regular maintenance schedule for the building. The cleaning process itself, as well as the close-range view of historic masonry afforded by the scaffolding or other access equipment, also provides an important opportunity to evaluate the condition of the building. Once rid of dirt and pollutant crusts, the condition of the masonry will be more clearly revealed.

One of the best reasons for a regular cleaning program is that it may remove efflorescent salts from the masonry, thereby reducing potentially harmful salt buildup within the masonry, which can cause spalling or delamination. Regular cleaning or washing can help control plant or other biological growth on a building; it is a safer and gentler approach than applying herbicides that are potentially harmful to the masonry.

Generally, regular cleaning or washing is good preservation and maintenance practice for calcareous stones such as limestone and marble. But it is not as necessary for the less soluble siliceous stones, such as granite and some sandstones, nor for some brick and some glazed architectural terra cotta, all of which have a harder, more impervious outer layer, and are thus better protected from dirt penetration than calcareous stones.



Figure 2. The building on the left is an obvious candidate for cleaning, as the heavy black crust may be concealing or contributing to deterioration of the stone. Despite its more recent cleaning, the stone facade of the house on the right exhibits the same distinctive, and hard-to-eliminate rainwater wash patterns under the eaves and window sills, as its unwashed neighbor.

Identifying the Masonry Substrate

Avoiding Damage

The first and most important step to be taken before beginning any masonry cleaning project is to identify the masonry. When dealing with stone, it is important to select a cleaning method or chemical solution best suited for the kind of stone—that is, one that will not dissolve or etch it. It is also useful to have information about the chemical and geological characteristics of the stone. (For example, although most sandstones may be safely cleaned using acidic cleaners, some sandstones are calcareous, and thus may be damaged by acid.) Gathering detailed geological data is not always possible if the factors of time and cost are prohibitive. However, it is essential that the generic stone be identified (i.e., whether it is limestone, marble, sandstone, or granite) because of the differing properties of porosity, solubility and hardness, and mineralogical composition. It is these properties that determine which cleaning methods can be used without adversely affecting the stone.

Tricks of the Eye

Another potential problem is that what might appear to be one type of masonry may actually be another. For example, architectural terra cotta, artificial cast stone, or pre-cast concrete were often manufactured to imitate natural stone. Pre-cast concrete or "cast stone" was being used imitatively as early as the late eighteenth century and still is to this day. Architectural terra cotta was used with this intent in the mid-to-late nineteenth century, and through the early twentieth century. Both materials were popular for decorative features such as window and door moldings. Terra cotta, in particular, was applied on upper floors of tall buildings where distance enhanced the illusion of stone.

Clearly, it is important to identify the material, since the best cleaning method for one type of masonry may not be as effective on another type, and may even cause damage. Many buildings feature a combination of materials. It is not unusual for a building or even a single facade to be composed of more than one type of masonry (brick with stone trim is particularly common), which may mean that more than one cleaning method will be necessary. If, after careful examination, there is any doubt about the type of masonry, a 3 percent solution of hydrochloric (muriatic) acid dropped from an eyedropper on an inconspicuous spot will quickly clarify the situation. This solution will bubble on calcareous stone, and on other acid-sensitive masonry, but will have no reaction on siliceous stone and acid-resistant masonry.

Indeed, some parts of a building, particularly decorative features, may not be masonry at all (figure 3). Frequently, such features as window hoods, cornices and balustrades may be metal, such as cast iron, galvanized sheet iron or zinc. When painted, they give an intentional appearance of masonry. Some features may have been fabricated of wood, then coated with a sanded paint to give the illusion of sandstone. Thus, the need to correctly identify the type of masonry, or other non-masonry materials on a building cannot be over-emphasized when planning a cleaning project.



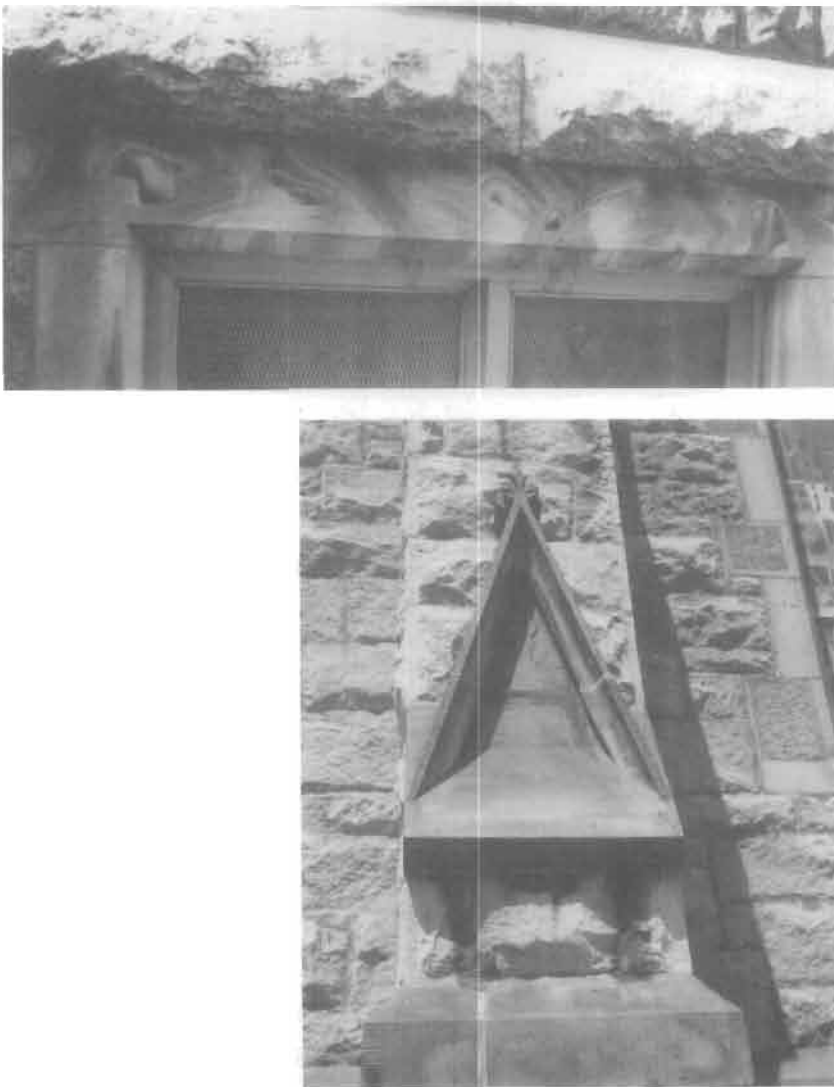
Figure 3. Know what you are cleaning. If the painted surfaces of the projecting bay window on this once elegant Second Empire brick mansion were still intact, it would not be easy to identify the beltcourse as sandstone, the windows and window frames as wood, and the cornice and all of the window hoods as pressed metal. Cleaning so many different building materials may require a variety of techniques and treatments.

Identifying the Substance to be Removed

After the masonry substrate has been identified, the next step is to identify the substance or substances to be removed. The more information available about the substance to be removed, the more successful the cleaning effort will be. For example, the cleaning project can be greatly facilitated by knowing the composition of each paint layer, the cause or source of the stains, the primary components of the dirt, or the probable source of the efflorescence. And it is not uncommon to discover that all or part of a building has been treated with water-repellent coating. Unless the coating has caused discoloration or streaking, the fact that such a coating exists at all may be known only if cleaning test patches fail to react as they would on uncoated masonry.

Dirt and Pollutant Crusts

Dirt or "soiling" on masonry buildings may consist of particles of dust, sand or grit, or tarry soot (resulting from incomplete combustion of fuels). The exact composition of the dirt will vary according to the geographic location of the building, as well as its use. A building in an urban, or heavily industrial area, is likely to exhibit a completely different type of soiling from a building in a rural or agricultural area—or a building near the seacoast or in the desert. While dirt and dust on one building may result from heavy vehicular traffic in the area, soiling on another building may result from human traffic.



Figures 4a-4b. Decorative architectural features that project from a wall surface, such as this granite belt course above an intricately-tooled limestone lintel, and this sandstone pinnacle topping a limestone buttress, may shield or protect masonry surfaces beneath them. But they are also responsible for creating unusual "wash" patterns and black crusts that form underneath them, further complicating cleaning projects.

Dirt or soiling may include disfiguring pollutant or sulfate crusts, which usually build up in sheltered or protected areas not regularly washed by the natural action of rain. It is particularly common under cornices, window sills, or other projecting decorative features (figures 4a - 4b). Some pollutant crusts resulting from a chemical reaction of stone to airborne particulate matter, or particles in which cementing material of the stone has actually incorporated itself, indicate the beginning of dissolution of the stone and incipient decay. Removing these crusts will necessarily involve a loss of a small amount of stone (figure 5). While removal is generally recommended because pollutant crusts hasten stone dissolution, extreme care must nonetheless be exercised to ensure that loss of the stone is minimized.

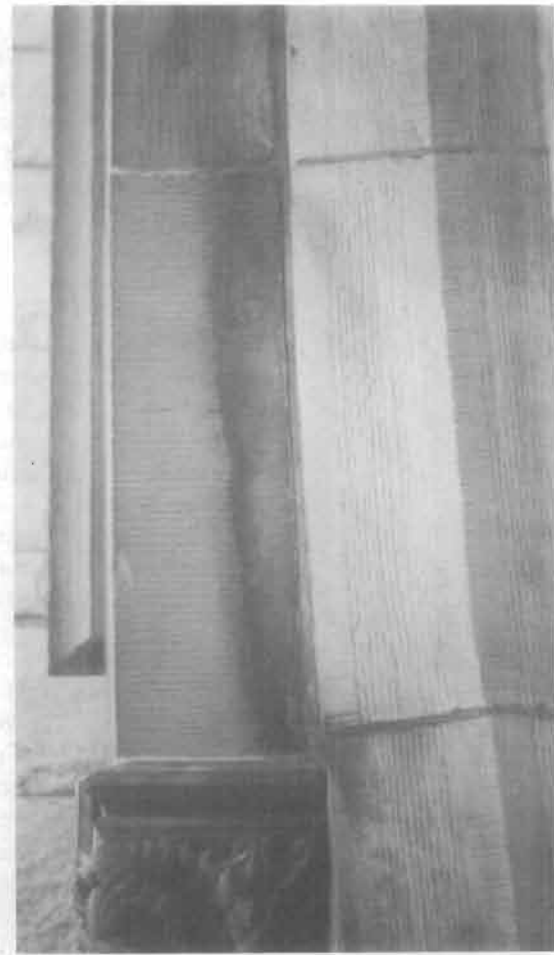


Figure 5. It is unlikely that this blackened crust can be removed without some loss of the tooled sandstone surface, because the sulfate crust has become integral with the stone.

Stains

Unlike particulate dirt, which tends to lie on the surface, stains in masonry are discolorations produced by foreign matter that has penetrated into—or permeated—the masonry. Stains can also result from a chemical reaction between the masonry and the foreign matter, or from impurities in the masonry itself. Common masonry stains include metallic stains caused by iron (rust) or copper, industrial stains of grease, oil, and tar, and biological and plant stains caused by lichens, mosses, algae, and fungal growth such as mildew. Even after removal of the vines themselves, ivy and Virginia Creeper can leave their “marks” on the masonry, which may also have to be removed by cleaning. Discoloration can also occur when mineral inclusions or impurities which occur naturally in some stones, or in the clay of some bricks, react to water or chemical cleaners.

Graffiti

Graffiti created with paint or another medium may also be considered a stain. If graffiti is sprayed-on, it is generally likely to permeate the masonry (unless glazed or polished) in the same manner as most other stains. Thus, its removal must usually be carried out in the same manner as other stain removal.

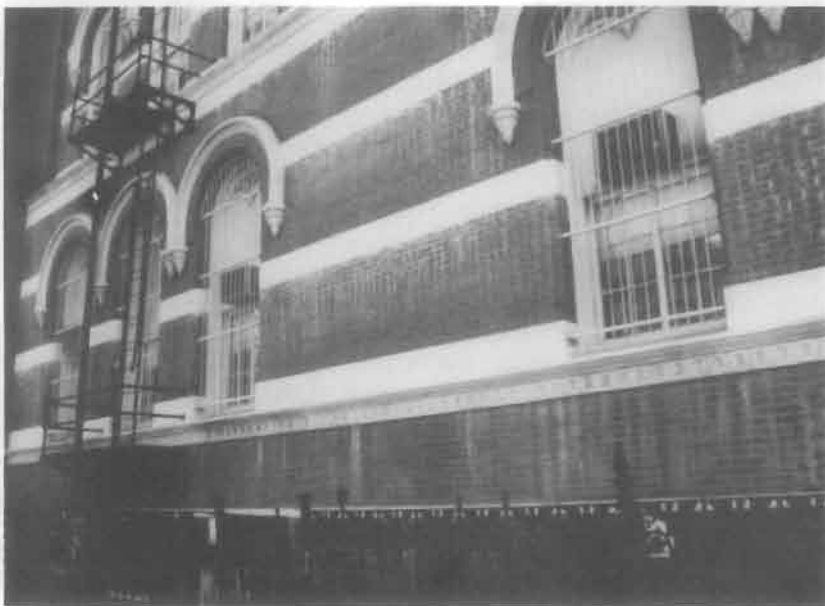


Figure 6. Chalking white paint from decorative metal and stone stringcourses has “bled” and run down the unpainted brick walls. Unlike efflorescence, for which it might be mistaken, chalking generally cannot be washed off, and paint remover will be required.

Paint and Other Coatings

Removal of paint or other coatings will, of course, be facilitated by knowledge about the kind or kinds of paint, and the number of layers to be removed. For example, it is useful, if at all possible, to know whether the paint is oil-based, water-based, or, as is often the case, whether it consists of a variety of paints and coatings, which might include layers of cementitious masonry paint, whitewash or limewash. In some cases, the pigment might be incorporated into the substrate, as is often typical of stucco and traditional limewashes.

Questions may arise about each layer or coating, further complicating the overriding need to remove the offending substance while not damaging the historic masonry. For example, if there is more than one layer of paint, is it consistent over all of the building surface? Or is there an “invisible” water-repellent coating or a wax coating, or perhaps even worse (from the standpoint of removal), an asphalt or bituminous waterproof coating on some areas? If so, will it come off successfully, or might it be better to camouflage it by repainting?

Efflorescence

Efflorescence, the result of capillary action pulling soluble salts up from the ground into the masonry, usually appears as a whitish haze on the exterior surface of masonry. Sulfate deposits may result from carbonates in lime mortar and airborne or water-deposited pollutants in the atmosphere. Another common source of efflorescence in brick is the firing process itself.

Efflorescence may also appear on a masonry surface after chemical cleaning. Some efflorescence is temporary, and will be removed by rain. Other types may disappear for awhile, but return periodically, and some require considerable and repeated efforts to eliminate. It is therefore always necessary to ascertain the source or sources of efflorescence, and it may even be useful to identify the salts that comprise the efflorescence. Further complicating the identification process, white paint from a painted surface above that has “bled” onto a

masonry surface below (particularly common under window sills) might be mistaken for efflorescence (figure 6). In short, it is very easy to misinterpret what is on the surface.

Combination Problems

Often, a cleaning project will involve removal of more than one substance. What first appears to be a straightforward task of paint removal may be complicated by the discovery of multiple layers of different types of paints and coatings on another elevation of the same building, or perhaps on only the first floor of the building. Moreover, what may initially appear to be one substance may, upon closer examination, turn out to be another, or often a combination of substances.

Project Personnel

Once the masonry and the substance to be removed have been identified, the next step is to match potentially appropriate cleaning methods with the particular project at hand.

Role of the Preservation Consultant

To ensure the best possible job, a professional preservation consultant should be retained, preferably someone with a technical or scientific background (an architectural conservator, a restoration architect, or a chemist or geologist). The advice of cleaning contractors or product representatives may be prejudiced by familiarity with only one or two cleaning techniques, or a desire to sell a particular product. Generally, their recommendations should not be substituted for the experience and impartiality of a technical preservation specialist or scientific consultant.

Basically, the consultant should supervise all aspects of the cleaning project—planning, identifying the masonry, identifying what is to be removed, selecting the cleaning methods and materials, selecting the contractor, and supervising the actual cleaning to ensure consistent quality and to minimize any possible damage to the surface.

Role of the Preservation Consultant

- Identify the building's materials.
- Evaluate condition of the masonry materials.
- Identify what is to be removed.
- Supervise the testing of the cleaning methods.
- Analyze the test patches.
- Based on the test patches, select the cleaning methods that most effectively clean the masonry without causing damage.
- Prepare specifications based on these test results (if they have not been prepared already prior to testing).
- Select cleaning contractor (if not already chosen).
- If possible, have cleaning test repeated by cleaning personnel who will do cleaning.
- Supervise actual cleaning process to ensure consistent quality.

Selecting a Cleaning Contractor

A carefully executed cleaning job requires the experience of a reputable cleaning contractor who specializes in cleaning and restoring historic masonry buildings. Negotiating a fair price with one qualified contractor may be preferable to asking several contractors to bid on the cleaning job. The bids and final contract should be based on specifications prepared by the independent preservation consultant. A good contractor should be willing to provide information on the cleaning process, and on the product ingredients, and also provide references in the form of completed cleaning projects.

It is important that a consultant, who is experienced in such evaluations, visit at least one or two projects in order to inspect the quality of the work. A well-executed cleaning project should not show any signs of mechanical or chemical abrasion, nor should it exhibit areas or patches of efflorescence, which might indicate the use of too strong a chemical or improper or inadequate rinsing. (Sometimes efflorescence on a very recently cleaned building is only temporary, and will gradually wash away. It may be the result of salt-laden moisture *within* the masonry

suddenly being released when surface dirt or a coating is cleaned off.)

A responsibly and sensitively cleaned historic masonry building should retain some of its before-cleaning patina, perhaps appearing slightly “dirty,” as if it had not been overcleaned. Clearly, however, there may be some aspects of a recently cleaned surface that are not so easy to explain. Sometimes an abraded or eroded surface is the result of natural weathering or a “flaw” in the original materials, or damage from an earlier, harsh cleaning treatment. Or what appears to be a stain may, in fact, be the result of an unexpected reaction of a natural impurity in the stone to a chemical cleaner. In short, as will be repeated again and again, it is not always possible to predict the exact outcome of a cleaning project because of the many variables associated with historic masonry. But despite some unavoidable uncertainty, a cautious, conscientious approach by the consultant, building owner or manager, and the contractor will always result in a better cleaning project—one that does not damage the historic masonry.

Although cost is often a factor in a cleaning project, the contractor should not be selected solely on the basis of a low bid, but rather on the quality of previous work, as well as on the basis of test patch results. Local historic district commissions and review boards, State Historic Preservation Offices, regional offices of the National Trust for Historic Preservation, local chapters of the American Institute of Architects (AIA) and the Association for Preservation Technology (APT), may be able to suggest reliable consultants and cleaning contractors experienced in cleaning historic buildings.

What to Require in a Contract and Specifications

Because cleaning a historic masonry building involves so many unexpected and unknown factors, each project is unique. It would be impractical to try to provide a standard set of specifications to cover *all* of the potential situations that might be encountered. But, while the actual specifications will vary from project to project, there are certain principles that should govern any cleaning project to ensure the best possible outcome.

1. The specifications should be very precise. The more specific they are, the less chance there is for mistakes.
2. Qualifications of project personnel should be included in the specifications.
3. If specifications are prepared before testing, they should clearly state that mock-up test areas will serve as quality-control for the project.
4. If testing has already been carried out, the specifications should state the exact cleaning method (technique and materials) to be used based on the testing.
5. If a specific product is to be used, it should be clearly stated so that the contractor is aware that *no* other product may be substituted, unless it is with the prior approval of the preservation consultant or supervising architect—and of course, only after it has been tested on the building. A building may often require more than one cleaning method or cleaning product. If so, each method to be applied to a different material and in a different location on the building should be identified.
6. The cleaning process should take place only under the careful supervision of a qualified professional preservation consultant or preservation architect. The cleaning method outlined in the specifications will have been prescribed only after careful testing on the building with time allowed for weathering. Any unforeseen problems that might arise during the course of the cleaning should be brought to the attention of the consultant (and the owner), and the cleaning halted until the problem is solved.
7. Finally, even a well-written specification is of no use if it is not read and followed.

Testing

Because of the wide variety of unforeseeable factors, the cleaning method or methods should always be tested on an inconspicuous area of the building and preferably in more than one location (figure 7). Such tests must be carried out before attempting any large-scale masonry cleaning project. Failure to do so may have disastrous consequences for the outcome of the cleaning as well as the long-term preservation of the historic building material. Testing should be carried out by the consultant or conservation specialist, or by the contractor, under the consul-



Figure 7. A contractor prepares equipment before testing a low-pressure water wash on a Roman brick and terra cotta building. Photograph: Sharon C. Park, AIA

tant's careful supervision. Carefully controlled testing is probably the only reliable way to determine the best or most appropriate cleaning techniques and pressures to be used in a particular project (figures 8-9).

Selecting an "Appropriate" Water Pressure

The process of selecting the most appropriate water pressure should always begin with the lowest pressure, or the "gentlest means possible," proceeding gradually to a higher pressure, as needed. Although that philosophy is certainly sound, its application in a practical sense is very much more difficult. The difficulty lies in the fact that, although the terms "low," "medium" and "high" pressure have traditionally been used in cleaning specifications, they are general terms and subject to wide interpretation. Because of incalculable or unpredictable factors associated with pressure equipment—combined with different types of historic masonry itself—it is virtually impossible to define the categories of low, medium and high in a manner that would apply equally to all cleaning projects.

Precise definition of these pressures is further complicated by the fact that pressure measurement, or psi (pounds per square inch) varies according to the following: pressure as measured by a

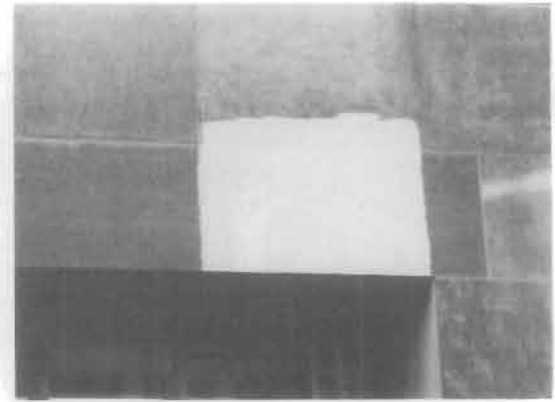


Figure 8. A test cleaning patch (unfortunately in a rather prominent location) on limestone discolored by urban grime and pollution reveals a marked color difference between the cleaned and the uncleaned stone as well as an unexpected discoloration (probably caused by a substance splashed on the wall at an earlier time). Removal of this spot may require a special cleaning treatment. Photograph: Sharon C. Park, AIA



Figure 9. A test patch on brick to remove a century of dirt reveals only a slight difference in appearance between the cleaned and the uncleaned brick. The hard-baked outer skin of the brick provides a surface that is not only impervious to dirt penetration, but resists dirt accumulation. Photograph: Christina Henry

gauge at the pump; the volume of water (or other liquid cleaning agents) delivered per minute; the size of the nozzle or spray head opening; and the distance between the spray head and the masonry surface. But since most psi measurements are taken at only one location, these seemingly precise measurements may bear little or no relationship to the actual pressure reaching the building. As the variables multiply, it becomes more and more obvious that psi numbers do not really mean very much, or at least do not mean the same thing to all who employ them in cleaning. Thus, although exact pressures may sound precise, the fact that they are not must be kept in mind.

For this reason, until a system can be perfected that will allow greater certainty or precision, selecting a cleaning method and pressure should be done only after careful testing has produced a satisfactorily cleaned test patch to serve as a standard by which the rest of the project can be measured. *Thus, references here to specific pressures are provided only for comparative purposes, and should be considered only as general guidance.*

Choosing Representative Types of Masonry

Finding the appropriate cleaning method can be further complicated when dealing with especially fragile, damaged or deteriorated masonry. These are factors that must be taken into consideration when planning to clean historic masonry.

Areas of the building chosen as test spots should accurately represent the types of masonry material to be cleaned. As noted earlier, another masonry material may have been used to simulate stone. Also, a harder, higher quality brick or "face brick" was often used on the facade, while the less visible side and rear elevations were often covered with a cheaper, usually softer "common brick" as an economy measure. Results from a cleaning test performed on common brick, or a heavily textured brick, would probably not be applicable to smooth, face brick. Likewise, tests on upper parts of a building may not accurately reflect conditions on other areas, such as the foundation or horizontal surfaces that may have been treated with a waterproof or water-repellent coating.

Choosing Representative Soiling

The area or areas selected for testing should represent both the amount and type of the dirt deposits, surface pollutant crusts, stains, efflorescence, or paint on the majority of the building surface. For example, a prominent area of the facade may be stained, disfigured with a heavy coating of soot, or covered by heavy paint buildup. Another area of the building may be only lightly soiled or have only one coat of paint. These might require very different cleaning procedures. A project that proceeds after testing a limited area only might produce very unsatisfactory results.

To ensure the most accurate test results, as much as possible of the dirt, bird droppings, or problem substances should be removed from the surface by hand-scraping or brushing with non-metallic brushes *before* test cleaning. (This same practice should, of course, be followed when the actual cleaning is undertaken.)

Evaluating the Test Patches

Although a somewhat larger area is preferable, an area approximately one square meter or approximately one square yard will generally serve as an adequate test patch. If there are different types of masonry, or widely dissimilar substances to be removed, several test patches may be necessary. Representative, but inconspicuous areas should be chosen in case any of the tests are not successful, or in case the project does not progress beyond the testing stage.

One building, regardless of size, may require a variety or combinations of cleaning methods. If the type of scaffolding allows, it is advisable to clean the entire building using the gentlest technique to remove the prevailing substance. Then, localized stains on decorative features can be addressed individually. Too strong a cleaner for overall cleaning may harm the masonry. Instead, a milder cleaning solution should be used and augmented, if necessary, by additional applications on hard-to-clean areas or difficult stains. *Always underclean, rather than overclean.*

Test patches can be evaluated accurately only after they are dry. If chemical cleaning is being tested, non-staining pH papers should be held on the surface of the test patch area before and after cleaning to determine if any acidic or alkaline residues remain on the surface. If residues are detected, additional water rinsing or application of a neutralizing solution should be carried out until pH tests indicate that all residues have been removed.

A test patch should be allowed to weather as long as possible before the cleaning project is begun to give ample opportunity for an accurate evaluation of the results. One year is the preferred amount of time; this allows the patch to be exposed to a complete weathering cycle (figures 10a-10b). If this is not feasible, it is a good idea to



Figures 10a-10b. This test cleaning patch on brick and sandstone was allowed to weather over a full year, while other aspects of the rehabilitation were carried out. Finally the entire building was cleaned with a proprietary paint remover sprayed-on under low-pressure and then rinsed by workmen from a truck-mounted hydraulic platform lift.

wait as long as possible, and at least one month at a minimum. Once a cleaning project is begun, the work should proceed in clearly defined areas (preferably delineated by structural or architectural features), since it is difficult to match cleaned areas, especially if the project is halted for several days or more.

Reasonable Expectations

Tests are usually carried out under optimum conditions, and may therefore show better results than the actual cleaning project. For example, a cleaning contractor bidding on the job will naturally try to achieve the best possible result in a sample cleaning area in order to obtain the contract. It is also easier to clean a small area at ground level within a specified amount of time than to achieve the same results several stories above ground by workers who are tired after a long day's work. Overly optimistic estimates of time and costs supplied by a contractor based on the results of a test patch can be misleading.

But an experienced and reputable contractor will be aware of these inherent problems and should be able to provide a reasonable estimate based on the testing.

The test patches serve as a "standard of clean" and will provide guidance regarding the best cleaning method for the job; for example, how many applications of the cleaning material will be necessary if a chemical product is used, the dwell time (the length of time an application should remain on the surface), and what pressures should be used for the cleaning and the final rinse.

Scheduling the Cleaning Project

One of the most important considerations in a cleaning project is scheduling. Since the cleaning method cannot be selected until several techniques have been tested, it follows that the test patches should be done at the start of a rehabilitation or restoration project. And, because of the need for adequate time for the cleaning tests to weather before selecting one, the actual cleaning itself should be the last, or one of the last things to be done in the project.

Never begin cleaning when there is any likelihood of frost or freezing, as most cleaning operations involve the use of water. When the water penetrates the masonry pores during cleaning, the interior of the masonry retains moisture for

some time before it evaporates, even though the exterior surface may appear dry. If a frost occurs, the moisture inside the masonry units will freeze, which could eventually cause the masonry surface to spall. The presence of salts within the masonry wall may exacerbate the process.

The best times to clean a historic masonry building (other than in tropical or arid climates) are late spring, early summer and early fall when there is no danger of freezing. While warmer temperatures contribute to a faster chemical reaction, too much sun and too high temperatures do not result in a good cleaning project either. If cleaning is done in very hot weather, the masonry should be shielded from excessive heat by hanging protective netting or tarpulins around it.

Repointing, if necessary, should generally be carried out before cleaning to prevent damage to interior surfaces caused by liquid cleaning materials penetrating through open joints in the masonry.

Minimizing Hazards of Cleaning

Although most large-scale cleaning projects should be carried out by qualified cleaning professionals accustomed to working with historic buildings, it is still important to keep in mind all of the precautionary guidelines associated with masonry cleaning. Potential harm to the historic masonry and other building materials often used in conjunction with stone and brick, as well as potential harm to the environment and cleaning personnel must be carefully evaluated before initiating a cleaning project.

Protecting the Historic Building

Mortars, especially those of the traditional lime-based formulations, are among the most vulnerable substances to be considered when preparing to clean a historic masonry building. Deteriorated mortar joints can lead to major problems with water washing and other aqueous techniques. The entry of large amounts of water through spraying or prolonged misting may result in damage to interior plaster and other finishes, and in exterior staining as well. Water pressures for cleaning and rinsing operations should be monitored carefully to minimize physical damage to the masonry. Loose mortar can

be dislodged by rinsing at too high a pressure, permitting deep penetration of water within the building.

The acidity or alkalinity of cleaning chemicals must be controlled to suit the chemistry of the individual masonry materials. Because chemical cleaning with acidic products is always potentially dangerous to acid-sensitive masonry and lime mortars, acidic cleaners must therefore be diluted carefully, in keeping with the sensitivity of the masonry. To accomplish this successfully, accurate identification of the masonry is essential. This may not be easy. Limestone and some cast stone, or other types of artificial stone, can look very similar.

Many other historic building materials can be damaged by chemical cleaning agents. Glass, glazed brick, and architectural terra cotta will be etched by strong solutions of hydrofluoric acid if not covered adequately. Metal, wood and paint can all be damaged by chemical cleaners, and must be shielded. Such materials can be temporarily protected by plastic sheeting or peelable coatings specifically made for this purpose (figure 11).



Figure 11. Removal of 100 years of grime from the brick and terra cotta facade of the Pension Building (now the National Building Museum), Washington, D.C., was accomplished by workmen on a swing stage using a chemical cleaning product. Note the polyethylene covering the windows to prevent damage. Also note the protective clothing for the workmen which hangs on the platform while not in use.

Photography: Christina Henry

Protecting the Environment

Damage to property, shrubs, trees and ground vegetation in the immediate vicinity can be avoided by using proper controls to avoid overspraying and by covering or shielding plants and property. Site drainage must always be considered when using an aqueous cleaning method, and disposal of toxic chemical runoff and dissolved paint may pose an even greater problem. Lead paint sludge should be placed in suitable containers and disposed of in accordance with environmental regulations. In the case of organic solvents, a well-designed storage location is necessary to prevent explosion and fire. Use of many of these cleaning materials may require special permits or approval from local authorities, especially if run-off is to be channeled into city storm sewers.

Protecting Cleaning Personnel

Cleaning compounds pose many safety and health hazards, and working personnel must be equipped with protective clothing, gloves and toxic vapor masks. Strong cleaning agents can cause skin burns and irritation, and adequate eye protection is essential at all times. Hydrofluoric acid can cause severe burns and can also penetrate the skin, resulting in bone damage. Organic chemicals are equally health-threatening, because they are absorbed systemically through the skin and are carcinogenic. When using spray equipment containing acid cleaners, extreme caution must be taken to release the pressure slowly so that the contents do not spray or splash the operator.

Part II

Choosing the “Gentlest Means Possible”

Most cleaning techniques suitable for use on historic masonry buildings rely on aqueous or water-based systems, and chemicals. Water-based solutions (which can include detergents) and chemical solutions can be successfully applied separately or in combination, aided by a variety of hand-scraping methods. Properly used, these techniques can safely remove dirt, stains, graffiti, paint or other surface coatings, efflorescences (salts), and plant and fungal growth and stains from historic masonry buildings.

Water Cleaning to Remove Dirt

all types of masonry

Water-based cleaning can be the gentlest and simplest operation, causing the least amount of damage, if certain precautions are followed. It may also be the least expensive cleaning procedure. It is probably the most versatile technique available for sensitive cleaning and removal of dirt and pollutant crusts from *all* types of historic masonry materials, and it is generally the *simplest* method for cleaning limestone and marble. While there are several cleaning methods in which water is the sole ingredient, water is also the principle cleaning agent in other methods which utilize detergents and chemicals.

There are four principal types of water washing: soaking (misting and spraying); low-pressure and medium-pressure water washing; low-pressure and medium-pressure water washing supplemented with non-ionic detergents; and steam cleaning, by itself, or supplemented with non-ionic detergents.

Soaking (Misting or Spraying)

Prolonged spraying with a fine mist is a relatively simple washing method. This technique provides maximum wetting using a minimal amount of water. A mist is produced by inserting fine mesh filters over hose nozzles. Continuous soaking of the surface is then accomplished by running lengths of punctured hose (or a

moveable pipe, or one supported on scaffolding) hung under the eaves or along the cornice line of the building. Water pumped up through a compressor at ground level slowly trickles down or sprays the building facade.

Low-pressure, low-volume misting devices with a wide angle of coverage may be the most efficient of the soaking techniques. They can also be set up to handle selected areas of heavy dirt or soot encrustation such as black sulphate or gypsum crusts that form in protected areas (especially under moldings and eaves not washed by rainwater) on limestone, marble and other calcareous stones. The effectiveness of this method relies on the fact that the sulfate crust, in which the dirt is incorporated, is several times more water soluble than the stone. Thus, water loosens the gypsum crust by partial dissolution, along with the material trapped within the network. As the description implies, this is a slow process and may take from four to six hours up to a week or more to soften heavy crusts or dirt deposits. After the dirt has softened, its removal can be facilitated by hand-scrubbing with non-metallic brushes or by using a moderate-pressure water wash; a wooden scraper may help in removing heavy sulfate crusts. A variation of this method is a timed schedule, or pulsed spray, which alternates periods of soaking (misting or spraying) with dry cycles, using a timer to regulate the intervals so the masonry does not dry out. This approach is also good for loosening dirt and pollutant crusts, although its use has been fairly limited in the United States. Before deciding to use any aqueous system, stone should be tested for free iron (iron not completely bound) to avoid the possibility of iron staining.

Low-Pressure and Medium-Pressure Water Washing

Another water-based cleaning method is low and medium-pressure “power” washing. It is always best to start with the lowest pressure possible, and to increase

the pressure only as much as necessary to loosen the dirt and adequately clean the building. Low-pressure water washing can be carried out with a common garden hose in a small-scale cleaning project, that is, one limited to a two-story structure that can be reached conveniently with a ladder. Again, removal of heavy grime can be facilitated by hand-brushing and scraping prior to washing. This is a very effective, gentle, and easily controlled method, unlikely to cause any harm to the building.

Low-pressure washing may also be successfully used for some large-scale cleaning projects, requiring scaffolding, or perhaps a "man lift" to provide access. Deteriorated areas will need specialized treatment, possibly by hand. After cleaning a building with heavy dirt encrustation, a final rinsing or a second cleaning using chemicals may be necessary in order to remove dirt already loosened by the initial washing.

Low-Pressure and Medium-Pressure Water Washing with Detergent Supplement

The best combination of prolonged spraying or dripping, low-to-medium-pressure washing, and brushing and hand-scraping, must be determined experimentally and on a case-by-case basis. While polished surfaces such as polished granite or glazed architectural terra cotta may sometimes be cleaned effectively of dirt simply with a low-to-medium-pressure wash, adding a non-ionic detergent that does not deposit a solid, visible residue, may often hasten cleaning. (Examples of non-ionic detergents include Tergitol by Union Carbide, Triton by Rohm & Haas and Igepal by GAF). Non-ionic detergents will also be needed to clean most textured masonry such as rusticated stonework, rough-surfaced brick, and intricately carved ornamental details; textured surfaces that hold dirt will require additional cleaning effort by hand-brushing with non-metallic brushes. After cleaning, it is important that the surface be carefully rinsed because, while not visible, a "gummy" detergent film tends to attract dirt.

With the exception of steam cleaning, which utilizes heated water, most water-based cleaning methods discussed here can be carried out successfully with cold water.

Under certain circumstances however, warm or hot water may facilitate the cleaning process when removing greasy or oily dirt or stains, and sometimes in paint removal.

Steam

Steam cleaning is another water-based cleaning method. Although once used extensively, it is no longer as popular, possibly due to the increased sophistication of chemical methods. In this procedure, steam is generated in a flash boiler and directed against the masonry surface with the use of a very low-pressure (10-30 psi) nozzle, generally with a ½ inch diameter aperture. The heat of the steam swells and softens dirt deposits enough so that the low pressure of the steam is generally sufficient to remove the loosened dirt from the masonry surface. However, the density of the steam makes it difficult for the operator to see or monitor the cleaning process, and because the steam is heated to such a high temperature, it is not only a potential hazard to the operator, but may damage the stone as well.

Steam cleaning is most useful today as a method of removing vine disks and other vegetation clinging to masonry surfaces, and for cleaning small, hard-to-reach or highly carved or ornamented areas without causing mechanical damage. In such instances, it may be necessary to precede the steam cleaning with manual scrubbing using a non-ionic detergent or a low concentrate chemical-based cleaner, or to follow steam cleaning with a low-pressure water rinse. Steam cleaning may also be a suitably gentle method for cleaning damaged or friable stone. Steam cleaning is a technique that, under careful supervision, may occasionally be used for specialized interior cleaning because it does not produce large quantities of water, and therefore reduces the possibility of damaging fine finishes.

Cautions and Precautions. Despite the fact that water washing methods may be the gentlest of all cleaning methods they are not without hazards. Even these methods can be abrasive. Water pressure should always be kept at the lowest level that will clean the masonry without damage. Too highly pressurized water can etch or otherwise scar masonry, and may penetrate through the masonry walls (figure 12).



Figure 12. Water at too high a pressure from a pin-point nozzle has etched this white Vermont granite. Photograph: David A. Look, AIA

With any aqueous cleaning system it is generally recommended that a masonry building be repointed, if necessary, before cleaning (allowing ample time for the pointing to cure adequately before cleaning, as the water may dislodge green mortar). Another possibility is to use caulking compound to fill in some of the larger gaps in the mortar joints temporarily to prevent water infiltration during cleaning. Before embarking on an aqueous cleaning project, it is important to make sure that the flashing around chimneys is tight, and that there are no open joints around doors and windows where water may enter.

Long periods of soaking or spraying may result in excessive moisture penetration of masonry walls, possibly leading to corrosion of metal anchors, and consequent exterior staining, or damage to interior plaster and paint finishes. To avoid these problems, cleaning personnel should inspect the interior periodically to check for moisture penetration. Prolonged soaking or spraying may also irreversibly weaken the masonry itself, since masonry, like other porous materials, tends to decrease significantly in mechanical strength when saturated.

Water cleaning of a moderate size building can require several million gallons of water. When such large amounts of water are involved, it is important to have a good drainage system available for the run off. Additionally, many city water systems may be heavily chlorinated or have a high mineral content. If this is the case, the water used for cleaning should be purified or distilled to avoid introducing chloride salts into the

masonry or mineral deposits onto the masonry surface. In addition, water should be pumped through plastic, rather than copper, pipes to avoid possible staining of the masonry. Water cleaning may be rather time-consuming and expensive, particularly if the removal of heavy crusts requires much hand-scrubbing.

It is important to realize that although some types of masonry may benefit from frequent water washing, others do not. While useful as a method of revealing sources of potential deterioration covered by dirt, frequent washing of some of the harder siliceous stones including granite and some sandstones, as well as brick, probably does not aid in their preservation. But the opposite is generally true of calcareous stones such as limestone and marble, whose long-term preservation may be enhanced by regularly scheduled water washing. Regular cleaning of calcareous stones (perhaps every seven to ten years in heavily polluted urban areas) can remove potentially harmful absorbed salts. On the other hand, calcareous stones also tend to be highly soluble and *too* frequent washing may result in accelerated dissolution and loss of surface caused by the slightly acidic water of some city water systems. In general, washing procedures for these stones should not be overly long to avoid excessive exposure of the stone to the dissolving nature of the water. The use of distilled water may further minimize dissolution.

To prevent possible staining of light-colored limestone or marble in areas where the local water supply has a high iron content, it may be useful to add a chelating or complexing agent such as EDTA (ethylene diamine tetra-acetic acid), to the wash water; this will combine with any metal ions present in the water and keep them in solution to avoid metal stains on light-colored stone.

Chemical Cleaning to Remove Dirt

If water-based cleaning is the gentlest and least damaging method of removing dirt from historic masonry, chemical cleaners represent the next level of intervention. Chemical cleaners may be required to remove heavy dirt buildup or layers of paint. Chemical-based cleaners for

masonry are generally one of three types: acidic cleaners, alkaline cleaners, or organic solvents. Acidic or alkaline cleaners are used for regular cleaning or dirt removal; alkaline cleaners or organic solvents are used for paint removal. All of these cleaners rely on water and most contain surfactants ("surface active" agents)—organic compounds that concentrate at oil-water interfaces, and exert emulsifying actions, and thus aid in removing soiling. (Sometimes the term "surfactant" is used interchangeably with "detergent.")

Pre-wetting masonry surfaces is generally recommended for both acidic and alkaline products. In addition to loosening the dirt, this reduces the amount of the cleaning agent and the dirt-laden rinse water that can soak into the masonry and the contiguous mortar joints. Chemicals are then brushed or sprayed on under low pressure—brushing the chemicals on may actually help loosen surface dirt. When surfactant products are used, spraying or brushing generates suds that boost cleaning efficiency by lengthening contact time of the active chemicals with the masonry. Manual scrubbing with a non-metallic brush can have the same effect, and also assists in loosening dirt. After a few minutes (as indicated in the product literature or determined by testing), the cleaner is washed off by flooding the surface with a moderate-to-high (400-600 psi) water spray at a rate of three to four gallons per minute, rinsing from top to bottom. Extremely heavy dirt accumulations or many layers of paint may require repeated applications of the chemical cleaner. A hot water rinse may also facilitate paint removal.

Acidic Cleaners

most granites, most sandstones, slate, unglazed brick, unglazed architectural terra cotta, concrete

Acidic products can be used on unglazed brick and terra cotta, and most granites, sandstones, slate and other non-calcareous or siliceous stones. But acid-based cleaners generally should never be used on acid-sensitive materials that might be etched or abraded by acid. This includes masonry with a glazed or polished surface (glazed architectural terra cotta, glazed brick, polished stone or glass) as well as acid-sensitive stone such as limestone, marble, or calcareous sandstone.

Acidic cleaning is a two-part process: first, the acid cleansing solution is applied to the pre-wet masonry surface. After completing its action, the acid solution is then removed from the masonry by a thorough water rinse. Hydrofluoric acid is the most commonly used acid cleaner for historic masonry, usually with some phosphoric acid added to prevent development of rust-like stains that may appear after cleaning. Hydrofluoric acid specifically dissolves carbonaceous pollutant products, or dirt, and in most cases does not leave water-soluble salts in the masonry if the cleaning is properly carried out. It should preferably be used at a concentration 0.5 percent, but may be used at concentrations as high as 5 percent.

Hydrofluoric acid works on granite, slate, sandstone and brick by dissolving a minute amount of their surface, thus releasing the dirt. In this way, the introduction of potentially harmful residual salts into the masonry is kept to a minimum. The masonry should be kept moist throughout the cleaning operation to avoid silica deposition (efflorescence or the formation of a whitish powder). As most chemical cleaners (both acidic and alkaline) must remain on the surface for several minutes, keeping the masonry moist will also maximize cleaning efficiency. A second or third application of the cleaning agent may be necessary to remove particularly heavy dirt deposits.

Most commercially available products contain thickening agents to form gels or pastes that improve the cleaning agent's ability to cling to vertical surfaces. They also contain secondary solvents of a lower evaporation rate than water, such as glycerine to enable the cleaner to remain moist longer on the masonry surface. However, care must be taken to avoid exposing the masonry to cleaners containing hydrofluoric or other acids for more than five to seven minutes.

A variety of commercially prepared acid-based cleaners for masonry is available: products for granite, brick and sandstone, afterwash products, concrete cleaners and mortar removal products. The principal ingredient in granite products (restoration cleaners) is hydrofluoric acid. The afterwash products contain weak organic acids such as acetic acid. The mortar removers and concrete cleaners are based on

hydrochloric acid. Many of these commercial products are very effective on historic masonry buildings if used according to the manufacturer's directions and under the supervision of a preservation consultant.

It may be difficult to obtain a list of all the ingredients or their exact proportions for most of these products, since they are usually of a proprietary nature, and not patented. However, the Occupational Safety and Health Administration (OSHA), requires that Material Safety Data Sheets be supplied by manufacturers to distributors upon request; they provide information about all hazardous contents in commercially available cleaning products.

Cautions and Precautions. Hydrofluoric acid-based cleaners can sometimes leave whitish deposits of silica, or calcium fluoride salts (efflorescence). These deposits are generally not harmful to the masonry but may be disfiguring, especially on darker masonry. Since this efflorescence is soluble in hydrofluoric acid, it can usually be removed by a second chemical treatment, followed immediately by a thorough cold water rinse. It should be noted that hydrofluoric-based cleaners left too long on the masonry may result in a colloidal silica deposit that may be almost impossible to remove (figure 13).



Figure 13. While hydrofluoric acid-based cleaners are often appropriate for cleaning unglazed brick, they may form hard-to-remove whitish silica deposits if left too long on the surface.

Although cleaning non acid-sensitive masonry with hydrofluoric acid-based products is generally a relative safe undertaking—using proper precautions—hydrofluoric acid may lighten the color of some sandstones containing iron. This is another reason why it is always important to test the product on the masonry before beginning a full-scale cleaning project. Hydrofluoric acid can also severely etch aluminum and glass; therefore, these materials must be covered with acid-resistant coatings for protection during cleaning.

Hydrochloric (muriatic) acid is a very strong acid and thus should generally not be used as a cleaning agent on historic masonry (even when diluted). Rather than cleaning or dissolving dirt, it dissolves lime-based mortars and even some stones, and leaves chloride deposits on the masonry surface. *The fact that it dissolves lime-based mortar as well as lime contained in some stones clearly illustrates that its use on historic masonry is generally inappropriate, since many historic mortars have a high lime content.*

When used as a cleaning agent, hydrochloric acid also tends to result in the formation of water soluble salts in the masonry itself, which even thorough surface rinsing is unable to remove. Some of these salts deposited within the masonry will probably appear on the exterior surface of the masonry as efflorescence, which may be washed off or brushed off by hand. However, not all of these chloride salts will migrate to the exterior surface. Salts remaining within the masonry may eventually cause spalling of the masonry units themselves. Furthermore, the use of hydrochloric acid may also result in the formation of yellow ferrous chloride stains on some types of masonry.

Commercially available acid-based cleaners usually contain varying combinations of hydrofluoric, phosphoric, hydrochloric (muriatic), sulfuric, acetic, and oxalic acid. As a final caution, it should be noted that despite the manufacturer's recommendations, commercially available "all purpose" cleaners that contain hydrochloric acid should not be used on limestone.

Generally, the only appropriate application of diluted hydrochloric acid to historic masonry is to remove excess mortar that

may have been splashed over the stone or brick while repointing, to remove white-wash or other lime or cement-based coating, or sometimes to clean concrete.

Alkaline Cleaners

limestone, marble, calcareous sandstone, glazed brick, glazed architectural terra cotta, polished marble, polished granite

Alkaline cleaners should be used on acid-sensitive masonry materials that would be damaged by acidic cleaners: limestone and marble, calcareous sandstone, glazed brick and glazed architectural terra cotta, and polished marble and polished granite.

Alkaline cleaners consist of two major ingredients: 1) a detergent (or surfactant), and 2) some type of alkali, usually potassium hydroxide. Following their application to the pre-wet masonry, alkaline cleaners are rinsed off with water; then the masonry is given a slightly acidic wash (for example, acetic acid) to neutralize the alkaline solution. The final step is to rinse the masonry with water a second time. Both potassium hydroxide and ammonium hydroxide (ammonia) are suitable alkaline cleaners for historic masonry. (Ammonia cleaners are especially effective in removing soil of a slightly greasy nature.) For lighter-colored calcareous masonry, a more uniform final appearance may require the addition of complexing agents (such as EDTA) and organic bleaches, but only under careful professional supervision. The effectiveness of alkaline cleaners, particularly for removing paint, wax coatings, grease and oil stains, may be increased by a hot water rinse (not over 160°F). Alkaline paint removers as well as alkaline cleaners for dirt removal from calcareous stones are used undiluted.

Cautions and Precautions. Sodium hydroxide (caustic soda or lye) generally should not be used on older or historic masonry. It is extremely harsh and can cause efflorescence and subflorescence, and may also cause physical abrasion and loss of small amounts of a brick surface (figure 14). Ammonium bifluoride is another alkaline cleaner that is commonly recommended as an "all-purpose" cleaner, but in general, ammonium bifluoride solutions are also not suitable for use on limestones, marbles, calcareous sandstones, or unglazed brick because of the likelihood of



Figure 14. Although the sodium hydroxide-based test cleaning patch on the right side of this wall of common brick appears to have been successfully cleaned, closer inspection reveals that a minute portion of the brick surface has been dissolved and removed by the cleaner. As a result, considerable brick dust can be seen in the cracks of the pavement beneath the wall.

leaving ammonium salts on the surface or within the masonry.

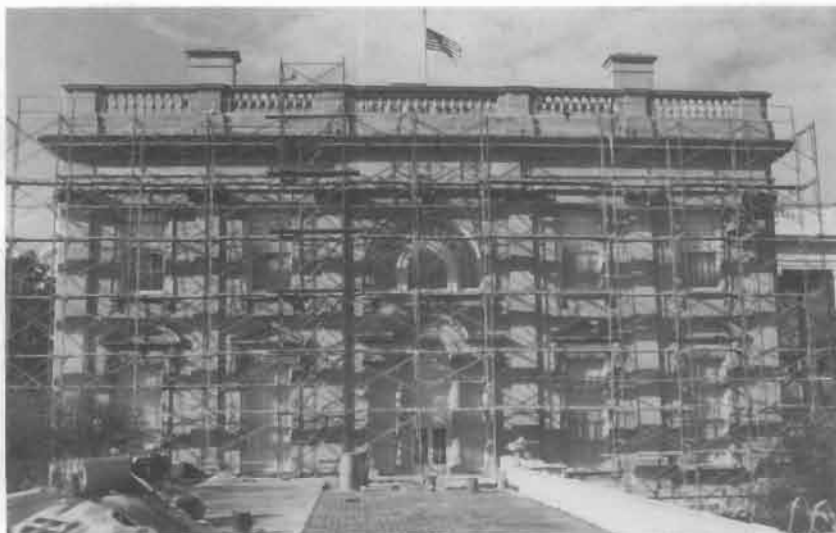
Surfactants and Detergents

polished granite, glazed brick, architectural terra cotta

Surfactants (without acids or alkalis) can be used on polished granite, glazed brick, and architectural terra cotta without risk of etching. Scrubbing with non-metallic brushes (or sometimes even hand-sponging) with a detergent is another effective method of cleaning these smooth surfaces. (However, it may not be possible to remove discoloration caused by dirt that has penetrated a crazed terra cotta glaze.) Non-ionic surfactants can be especially effective in removing oily or greasy dirt.

Chemical Cleaning to Remove Paint and Other Coatings

Large-scale paint removal from historic masonry buildings can best be accomplished with chemical paint removers, based either on organic solvents or alkaline solutions. Commercial paint removers are



Figures 15a-15b. If a highly articulated facade is being cleaned it may be necessary to scaffold the building, one elevation at a time. When the monumental task of chemically removing all the paint from the White House was begun, each side was scaffolded in preparation for repainting. Removal of the many layers of paint that had obscured the stone tooling marks for almost a century, without damaging the historic sandstone, required much painstaking hand work.

Photograph: National Park Service

generally formulated to remove most types of paint (except cementitious or lime-based paints such as whitewash) from all types of masonry. But it is always preferable to use an alkaline paint remover on acid-sensitive masonry (figures 15a-15b).

Alkaline Paint Removers

limestone, marble, calcareous sandstone, glazed brick, glazed architectural terra cotta, polished marble, polished granite

One type of paint remover is based on ammonium hydroxide (ammonia), potassium hydroxide, or trisodium

phosphate. This alkaline-based paint remover is best used on calcareous and other acid-sensitive masonry, and is particularly useful for removing oil, latex and acrylic paint. (Many paint removers are composed primarily of sodium hydroxide—caustic soda or lye—which, as explained earlier, should not be used on historic masonry because of the likelihood of depositing harmful salts.)

Organic Solvent Paint Removers

A second type of paint remover is composed of a combination of organic solvents, which almost always includes methylene chloride, and others such as methanol (wood alcohol), acetone, xylene, and toluene. Organic solvent-based cleaners are particularly effective in removing more recently developed coatings, including epoxy and urethane-type coatings. However, methylene chloride-based cleaners may also tend to spread some stains deeper into the masonry, so they must be applied with caution, and of course, only after testing. Both types of paint removers are applied either with a brush or sprayed on the masonry surface. The addition of gels, thickeners and waxes prevents paint removers, which evaporate rapidly, from drying out so that they may remain active on the surface for several hours.

The softened paint is then washed off using a water rinse that may range from as low as 200 psi to possibly as high as 800 psi. Efficiency of the paint removal differs from project to project. Multiple layers of paint may require two or more applications of paint remover, or the use of several types. An intricately carved, rough or damaged masonry surface will also take more time and may not result in a surface completely free of paint. If the paint has penetrated into the masonry, total paint removal may be impossible to achieve without damaging the surface.

Removing Other Coatings

Traditional lime-based whitewash or color washes that have deteriorated and no longer bond to the substrate, may be removed with hydrochloric (muriatic) acid—which will dissolve the lime (*and also the masonry substrate if it is not applied with caution*)—or sometimes with acetic acid, and hand-scrubbing with non-metallic

brushes. Sometimes prolonged wet poulticing may also be necessary. Twentieth-century cement-based, or textured coatings, may be very difficult to remove without damaging the masonry. They are not likely to be soluble in paint remover, although occasionally hydrochloric acid may be effective, and sometimes they can be removed by hand-scraping. Removal of acrylic water-repellent coatings may usually be accomplished with an alkaline, possibly potassium hydroxide, solution.

Cautions and Precautions. In particular, those paint removers based on organic solvents should be handled with extra caution. Most organic solvents are flammable. Their vapors, easily absorbed through the skin and the lungs, are carcinogenic, and some are irritating to the skin.

It should be noted that the use of heat (applied with a propane torch or similar device) is *never* an acceptable method of paint removal from historic masonry. Not only is heat ineffective, it may actually damage the masonry, and cause softened paint to permeate porous masonry. Furthermore, use of a propane torch also introduces the hazard of fire to historic materials. Finally, the use of high-pressure water in itself is also not an effective or acceptable method of paint removal from historic masonry.

Poulticing to Remove Stains

The first step in stain removal is to identify the stain; the next step is to try to prevent recurrence of the problem by getting at its source. This source may be integral to the configuration of building materials in a historic structure, and as such, may not be feasible to eliminate. For example, copper flashing will often stain light-colored stone or brick. And the more porous the masonry, the greater the tendency for the masonry to become stained. Thus, while glazed brick and architectural terra cotta are generally resistant to penetrating stains, limestone and marble are considerably more likely to stain because of their porous nature. The fact that acids should not be used on acid-sensitive materials frequently means that, while an acid might indeed be capable of removing a certain stain from brick or a siliceous stone, an alternative, non-acidic cleaner must be substituted when dealing

with a calcareous or otherwise acid-sensitive masonry type. There are many premixed poultices commercially available that are based on much the same composition as those described here.

Frequently stains will be removed during a general cleaning of the masonry. But the removal of disfiguring stains, graffiti, and efflorescent salt deposits from masonry is often a complex and challenging undertaking. It is complicated by the fact that, unlike particulate dirt which tends to sit on the surface, stains generally penetrate into and permeate the masonry.

For this reason, poulticing is generally the most effective means of removing stains from historic masonry. Efficient stain removal requires that a cleaning solution (selected according to the type of stain) be kept in contact with the stained area for as long as possible, and that the cleaning solution pull out the staining material without redepositing or spreading it on the masonry itself (figure 16). Poulticing methods meet all these requirements.

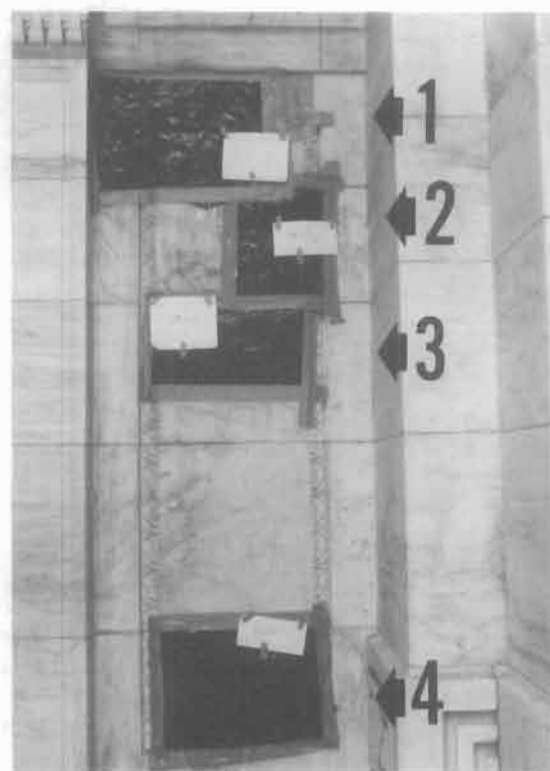


Figure 16. Four different poultice mixtures were tested to remove metal stains from this marble wall. From top to bottom, they included a commercial poultice, as well as formulations of peroxide and hydrated lime, ammonia and hydrated lime, and sodium citrate and glycerine with hydrated lime. Photograph: The Ehrenkrantz Group

Simply stated, a poultice is composed of an absorbent material or powder, mixed with a liquid to form a paste or slurry. The absorbent powders or chemically inert fillers used to make up the poultice not only slow the rate of evaporation or reaction, allowing adequate time for the solvent to dissolve the stain, but also provide a vehicle to accept the staining material after it has been pulled from the masonry. Among the powders commonly used for poulticing are clays (such as attapulgite, kaolin and fuller's earth), talc, chalk (whiting), sepiolite (hydrous magnesium silicate), diatomaceous earth (kieselguhr) and methyl cellulose. While absorbent clays and diatomaceous earth are the most efficient, whiting and kaolin are the cheapest. It should be noted that the absorbent material for a poultice does not always have to be powdered, but can consist of shredded acid-free paper or absorbent cotton or cotton pads. (Generally, whiting, or iron-containing clay such as fuller's earth, should not be used as the absorbent ingredient if an acid is used as the solvent; they will react with, and thus, negate the effectiveness of the acid.)

Next, the type of solvent (liquid) is chosen to match the requirements of the stain to be removed. It will either be water for a chemical poultice or an organic solvent for stains that are soluble only in solvents. A heavy or thick poultice may require additional support on vertical surfaces in the form of a non-ferrous, or plastic mesh which can be held against the wall with non-staining fasteners. The poultice will clean more effectively if kept wet throughout the dwell period. It can be covered with plastic to prevent it from drying out too rapidly, and can also be re-wetted if it dries too quickly without having removed the stain. If a single poulticing operation is not effective, a second application can be made. After removing and discarding the poultice material, the area should be thoroughly rinsed with clean water to cleanse the masonry of any chemical residue (figure 17a - 17d).

The poultice is applied as follows: a $\frac{1}{4}$ - $\frac{3}{4}$ inch layer of the paste is applied to the masonry surface, and the liquid is absorbed into the masonry to act upon the stain. As the poultice dries out, the liquid is re-absorbed back into it, drawing out the stain. The poultice is allowed to dry completely, and is removed gently by

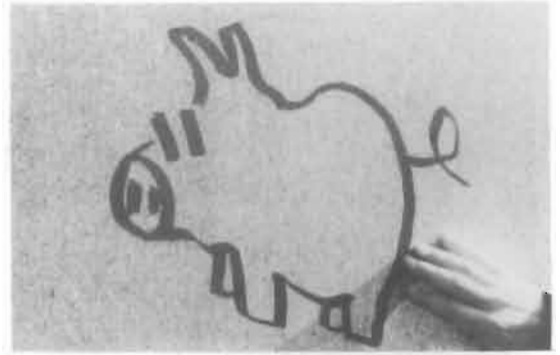


Figure 17(a). This graffiti was applied with a wide felt-tipped marker to a polished granite wall. To facilitate removal and to prevent the image from penetrating further into the stone, the masonry surface was first wetted with denatured alcohol.

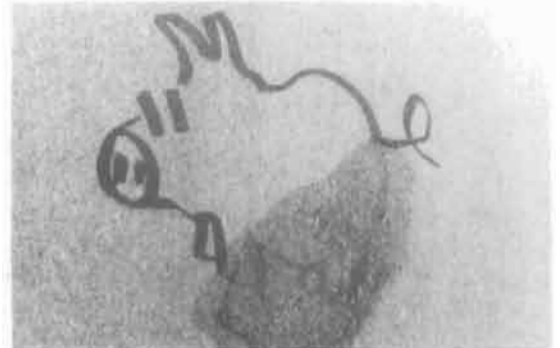


Figure (b) Most of the image was removed using a rag saturated with a mixture of solvents, including acetone, lacquer thinner and N-methy-2-pyrrolidone.

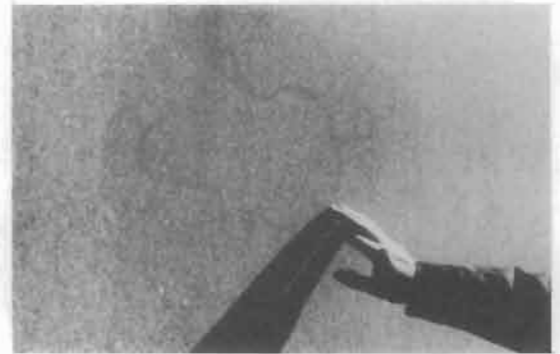


Figure (c-d) The slight ghost outline remaining was easily removed with the solvent mixture in a poultice composed of attapulgite and Kaolin clays and whiting, and followed by a thorough detergent and water wash. Photographs: Nicholas F. Veloz

hand with a wooden scraper or non-metallic brush.

Metallic Stains

In general, metallic stains on siliceous or acid-resistant surfaces can be removed effectively with a weak acid solution.

Metallic stains on acid-sensitive masonry should be removed using an alkaline salt of the appropriate acid (for example, ammonium oxalate to remove rust stains).

Metal compounds are responsible for a great number of stains on historic masonry structures. Of these, rust stains from iron are probably the most common. The orange color is caused by small particles of hydrous iron oxide. Most rust stains are directly related to the corrosion of exterior ironwork such as porch railings and grillwork, or concealed interior support mechanisms such as iron anchors and tie rods. Corrosion is usually initiated by water penetration into the building, primarily via cracks and open mortar joints, and the stains will continue to reappear if these leaks are not repaired. However, some rust stains are due to certain iron-containing minerals, such as pyrite, that may occur naturally in the stone and, as such, cannot be removed.

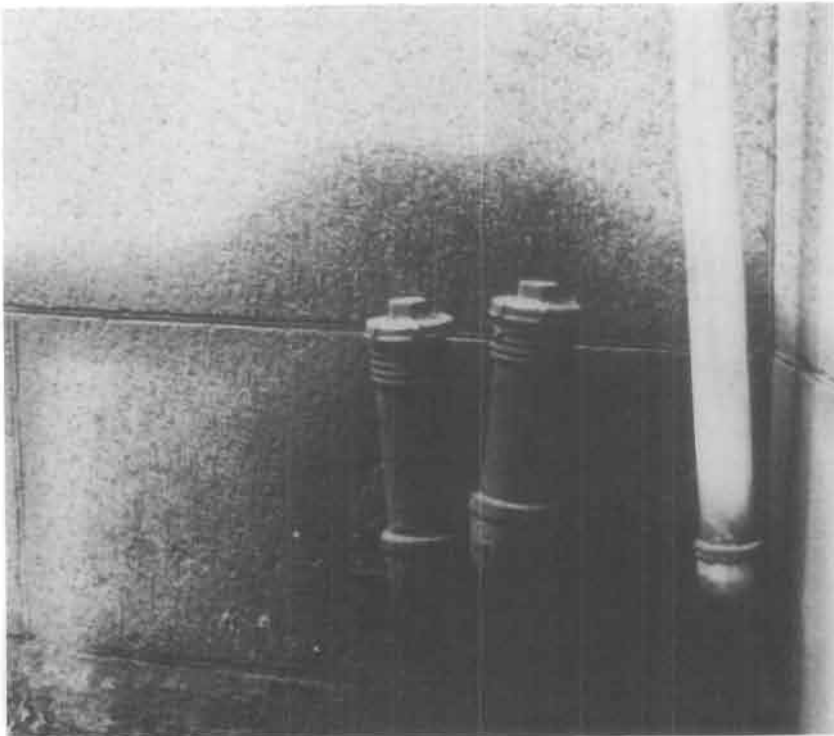


Figure 18. Removal of this oil stain which has penetrated deep into the granite will necessitate poulticing with an organic solvent.

Green stains are usually associated with the presence of a number of copper compounds. Copper roofing, brass ornaments and bronze hardware and sculpture are among the obvious sources of green staining. Copper and bronze stains are usually not difficult to eliminate successfully.

Generally, they are soluble in an ammonia solution (aqueous ammonium hydroxide).

Industrial Stains

Industrial stains result from contact with such materials as fuel oil, asphalt and tar. Some superficial (or surface) industrial stains, like smoke and soot and oil, may be removed by gently scrubbing with a scouring powder containing bleach (but not household bleaches which are sodium-based) or water-based household detergents that are acid and alkali-free. However, scouring powders sometimes contain abrasives which may damage delicate masonry surfaces. Ammonia also dissolves some superficial oily stains; thus, a solution of ammonia and water applied in a poultice is useful for removing oil and grease stains from marble. But most procedures for the removal of these oily stains require the use of organic solvents. Because flooding the surface with solvents is both inefficient and costly, brushing with an emulsion of organic solvents such as mineral spirits may be more effective. A water rinse afterward is necessary.

Industrial stains that have penetrated more deeply into the masonry should not be rubbed in, but should always be removed with a poultice (figure 18). An appropriate solvent (or solvent mixture) must be selected. This will probably involve some testing to find a solvent best suited to the type of stain. Among the common organic solvents that may be effective in removing industrial stains are the following: naptha, mineral spirits, chlorinated hydrocarbons (such as methylene chloride and perchloroethylene), ethyl alcohol, acetone, ethyl acetate, amyl acetate, toluene, xylene, and trichloroethylene. (A slight variation of the poultice method consists of thoroughly soaking the stained area with the solvent, and immediately covering it with absorbent powder.)

It may not always be possible to remove all traces of asphaltic stains, but their visual impact will be substantially reduced

by using these methods. Additional washing and scrubbing with detergent or scouring powder following application of the poultice may further reduce staining.

Removal of larger chunks of asphalt or tar accumulations may be facilitated by applying dry ice or spraying with carbon dioxide. The asphalt or tar will be embrittled by the dry ice or carbon dioxide, and after tapping with a small hammer, can usually be removed from the masonry surface by prying it up with a putty knife, (figure 19). This same technique can be used for removing gum, adhesives or other sticky substances. Such techniques, however, should not be used on wet masonry, as they may freeze the moisture in the masonry, and cause cracking or spalling. Organic solvents or bleaches are also effective, sometimes in a poultice, on sticky substances.

Biological Stains

Heavy growths of *lichens*, *algae*, *moss* and *fungi* should be removed from masonry surfaces. Lichens in particular, and mosses, tend to encourage stone or masonry deterioration, because they produce oxalic acid, and, because like other plant growth, they attract—or are attracted to—moisture, one of the major enemies of masonry. Thus, in most cases, it is best to eliminate all plant, lichen and algae growth on historic masonry.

Lichens and algae can usually be removed with water and a stiff natural bristle brush, after soaking, if necessary (figure 20). Stains caused by plant growth such as mildew (which is a fungus) can sometimes be removed with organic solvents, but are generally best treated with diluted ammonia or bleaches. Hydrogen peroxide can also be effective. Calcium hypochlorite solutions and pastes (the basis of swimming pool chlorine) and Chloramine-T may also be useful in many cases. Chemical removal of the growth itself may sometimes be accomplished with zinc or magnesium fluorosilicate, copper naphthenate, or with a variety of quaternary ammonium salts. Low-to-medium-pressure (100-400 psi) water rinsing can be used to eliminate much of the plant material prior to treatment and stain removal. However, these compounds should be used with caution, as some copper compounds may stain light-colored



Figure 19. Efficient removal of tar splatters from limestone and sandstone may be facilitated initially by applying dry ice or carbon dioxide, but complete removal will probably require poulticing with an in-organic solvent.



Figure 20. Plant growth such as lichens growing on a protected side of this limestone and granite parapet wall, can be damaging even to a relatively hard stone like granite because lichens secrete oxalic acid. Lichens can usually be removed, after soaking with water by scrubbing with a stiff natural bristle brush.

masonry, and the use of zinc or magnesium fluorosilicate may result in formation of a surface crust on some masonry.

Other growing vines such as ivy and Virginia Creeper should be cut at the roots, and allowed to dry before removal to prevent the disk-tipped tendrils

characteristic of these plants from dislodging parts of the masonry. Once the plants have dried up they can be carefully pulled off; the roots should be killed (ammonium sulfamate may be applied to the roots if necessary, taking care not to get it on the masonry). Any remaining dried plant material on the walls can be removed by scrubbing with a non-metallic brush, and then washed off (figure 21). Except in extreme cases, herbicides should not be used to remove algae, moss or lichens because of the danger of introducing additional salts or acids into the masonry, as well as the potential for creating environmental problems.

Most of these forms of plant growth on masonry buildings—algae, moss, lichens and fungi—are a direct result of moisture in the masonry and lack of sunshine. Thus, unless the specific conditions change, i.e., the moisture problem is eliminated, or the masonry is given more exposure to the sun, they will recur continually (figure 22). A leaking downspout or gutter can be repaired, a tree or bush too close to the building can be trimmed or pruned to introduce more sunlight, and even lawn sprinklers can be redirected so they do not repeatedly deposit excessive amounts of water on the same area of a building surface (figure 23).

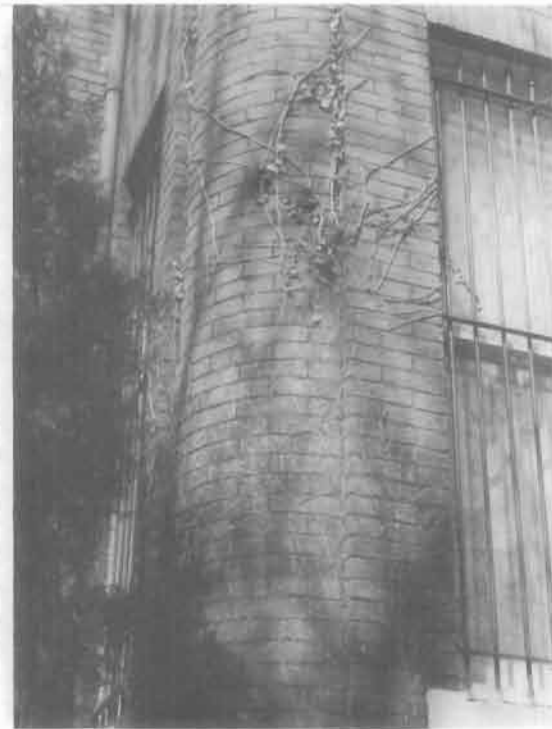


Figure 21. After the ivy was cut at the roots, it has been allowed to wither and die before being pulled off the wall. Most of the ivy has been removed, but a few tendrils still cling higher on the wall. After these have completely dried and have been pulled off, the remaining dried plant material can then be removed from the brick by scrubbing with water and a bristle brush.



Figure 22. The discoloration on this white marble is a green-colored algae growth on a shady side of the building and caused by water dripping from the air-conditioner above it.



Figure 23. The moss growing around the downspout and along the base of this stucco building clearly indicates the presence of excess moisture—here due to rising damp as well as a leaky downspout. Photograph: Lee H. Nelson, FAIA

Graffiti

As with other types of cleaning problems, it is always preferable to identify the substance used to create the graffiti before selecting what is likely to be the best remover. If there is any possibility of discovering how the graffiti was applied (such as discarded spray paint cans in the immediate area), it is worthwhile to investigate, since the manufacturer of a particular product may be able to provide specific information concerning the ingredients of the paint, and thereby simplify the task of removal. It is also important to be aware that it may be extremely difficult, if not impossible, to completely remove all traces of some types of graffiti. Successful and total removal of graffiti may depend on the type and surface texture of the masonry, as well as the particular substance applied. After its removal, which is essentially a spot cleaning operation, the masonry surface may appear spotty. If too unsightly, cleaning the entire surface or wall may be necessary. Sometimes it may be easier to "redirty" slightly the cleaned area to blend in with the uncleaned wall.

Like most other cleaning projects, successful graffiti removal will probably involve a "trial and error" approach, unless the material used to apply it can be readily identified before cleaning is begun. And, as with any type of cleaning of historic masonry, the gentlest method

possible should always be tried first; otherwise, one may run the risk of permanently etching the graffiti into the masonry surface.

Painted graffiti applied from a spray can or by a felt-tipped marker or lipstick may generally be removed from masonry by a commercial paint remover—either a solvent type of remover such as lacquer thinner or acetone, or a methylene chloride-based remover (figure 24). In some instances, poulticing may not be necessary. If the graffiti has not permeated deeply into the masonry, it may be removed by the paint remover or a solution of trisodium phosphate brushed on with a non-metallic brush. After the paint has softened, as much as possible should be scraped off with a wooden scraper. Then the area should be washed again using a detergent and soapy water, and rinsed thoroughly with water.

A variety of commercial solvents are available on the market, which may contain aromatic non-chlorinated solvents such as xylol, toluene with methanol or ketone, or chlorinated hydrocarbon solvents such as methylene chloride. But before trying these solvents which, as noted, are effective but are also very toxic and dangerous to handle, it is always best to try something milder, such as a detergent solution and water combined with hand-scrubbing with a non-metallic brush.

Although many cleaning contractors may advise application of a coating to protect masonry surfaces that are particularly vulnerable to defacement by graffiti, a coating is generally not recommended. Historic masonry may be discolored or damaged more by such coatings, which may inhibit moisture evaporation, than by the graffiti. Furthermore, the coating itself is likely to be removed by subsequent graffiti removals.

Salt/Efflorescence

Efflorescence is a whitish powder made up of excess salts that have crystalized on the masonry surface. Because efflorescence may have many causes, it is important to identify the source of the problem. For example, although efflorescence is usually a sign of excessive amounts of moisture in the masonry, it may also result from



Figure 24. Spray-painted graffiti on this brick wall can be removed with paint remover, and in this case, probably will not require poulticing.

chemical cleaning or repointing if the masonry is not thoroughly rinsed. It may also come from heavy use of de-icing salts, or rain penetrating masonry through deteriorated mortar joints may result in efflorescent patches on an entire facade. Finally, air pollution often results in the formation of thick sulfate (salt) crusts on the underside of moldings and eaves—areas not regularly washed by rainfall (figure 25).

Efflorescence can usually be brushed or washed off with water since it is formed of



Figure 25. Excess moisture leaching out through the walls has resulted in the formation of white efflorescent salts on the brick and blackish sulfate salts on the limestone water table.



Figure 26. Efflorescent salts appearing on many of the brick piers of this turn-of-the-century building may indicate the existence of clogged interior gutters that, because they no longer function have been supplemented by an exterior rain removal system. Photograph: National Park Service

water soluble salts. Some efflorescence that results from cleaning may eventually disappear through normal rain washing; however, some chemical residue left from the cleaning process can form damaging insoluble salts. Efflorescence resulting from water penetration into the masonry structure will continue to reappear unless the source of the water entry is removed; thus, the first task is to identify the point of entry and stop the water penetration (figure 26).

Sulfate encrustations often may be removed with a heavy wooden scraper. But removal of particularly heavy salt buildup may also require a poultice of one of the following: diatomaceous earth, cotton, crushed dolomite, crushed limestone, or shredded polyester fiber soaked in distilled water. The area of the masonry that displays efflorescence should also be soaked in distilled water before applying the poultice to avoid redistributing the salts back into the masonry.

Cautions and Precautions. Several points need to be made regarding the use of chemicals in poultices. First, copper stains should never be removed from limestone with potassium cyanide or sodium cyanide as is sometimes recommended. Both of these cyanide compounds can be lethal to cleaning personnel. Second, most organic solvents are flammable. Their vapors, easily absorbed through the skin and the lungs, are carcinogenic, and some are irritating to the skin. Third, bleach should never be used in conjunction with ammonia in a poultice; this simple-sounding household combination produces toxic chlorine gas that may cause lung tissue damage or death. Finally, spraying liquid nitrogen or asphalt or tar will make it brittle and thus removable, but it is highly flammable and so dangerous to work with that a user must be specially licensed.

Other Methods of Stain Removal

While it is usually necessary to employ a poultice to remove most stains on masonry, other, sometimes simpler, procedures may also be effective. If a stain is superficial, it may often be eliminated by applying a chemical remover or solvent with brushes, or by “washing” the solvent over the surface using a low pressure (under 100 psi) spraying apparatus. It may also help to coat the surface with talc

or similar material to help absorb the stain in a sort of simplified poultice. To prevent outward migration of the staining agent, which would increase the size of the stained area, the masonry immediately adjacent to the stain on all sides should be thoroughly prewetted. Following application of the cleaning solution, the masonry must be rinsed off, and the entire procedure repeated, as necessary. Rinsing need not be done with pressure; in fact, it is normally sufficient to gently flood the treated surface for several minutes.

Cautions and Precautions. Mechanical or abrasive procedures such as sandblasting, grinding or chiseling to remove dirt, paint, stains or graffiti are not acceptable methods of cleaning historic masonry. Such abrasive methods may—with varying degrees of success—remove the offending substance from the masonry, but may also damage the masonry by removing or abrading the outer surface layer (figure 27). Very loose or flaking paint or a similar coating on smooth surfaces, such as brick, may sometimes be successfully removed by careful hand-scraping in preparation for repainting, but the physical irregularities of most rough-cut or carved surfaces make this impractical. Furthermore, abrasive cleaning techniques may also be harmful to the applicator, passersby and public property.

Cleaning to Remove Bird Droppings

Removal of small amounts of bird droppings may be accomplished as part of a regular cleaning project with cold water washing, possibly supplemented with detergents and chelating agents such as EDTA (ethylene diamine tetra-acetic acid), or on non-acid sensitive masonry with acidic cleaners, where appropriate. Removal may also be facilitated by brushing with a non-metallic brush and scraping with a wood scraper (figure 28).

In some instances where particularly porous types of stone may have been stained by heavy accumulations of droppings that have permeated into the stone over the years, they can be removed by using a combination of the above materials.

Cautions and Precautions. Histoplasmosis and cryptococcosis, both potentially fatal



Figure 27. Heavily pitted by sandblasting, this window recess provides a vivid contrast to adjacent undamaged brick protected from abrasion by a metal signboard.

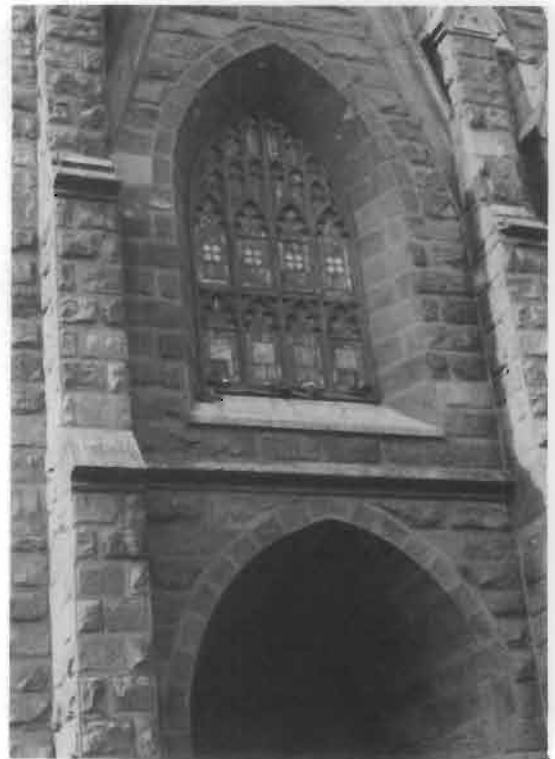


Figure 28. If water, or water and detergent wash, does not remove the pigeon droppings from this sandstone sill and stringcourse below, it may be necessary to use a dilute acidic cleaner containing hydrofluoric acid, providing the sandstone is not calcareous and thus, acid-sensitive.

diseases of the lungs and central nervous system, can result from exposure to accumulations of pigeon excrement. Because of this disease potential, it may be better to apply water pressure from a safe distance to remove excessive amounts of droppings and better not to attempt total removal, particularly if droppings are not highly visible or do not appear to be

damaging the masonry. Bleach should not be used as a component of any removal process; bird droppings contain ammonia, which forms toxic gases when mixed with some bleaches. When removing bird droppings, cleaning personnel should guard against exposure to the attendant health hazards by wearing protective masks and clothing.

Part III

Summary of Guidance

The “Gentlest Means Possible”

Although masonry may be one of the most durable of historic building materials, it is nonetheless susceptible to damage by improper maintenance or repair techniques and by harsh and abrasive cleaning methods. Thus, cleaning historic masonry is recommended only when necessary to halt deterioration or to remove heavy soiling, and *only* after careful testing. Observing the “gentlest means possible” rule

always means beginning with a low-pressure water wash, supplemented, if necessary, with non-ionic detergents and scrubbing with non-metallic brushes. If this very gentle method does not clean the masonry, or if paint or stains must be removed, the next step is to use a chemical cleaning process. Abrasive cleaning methods are damaging and are not suitable cleaning techniques for historic masonry buildings.

Summary of Cleaning Techniques*

Substance to be Removed	Acid-Sensitive Masonry	Non-Acid-Sensitive Masonry
	Limestone, Marble, Calcareous Sandstone, Glazed Brick, Architectural Terra Cotta, Polished Granite	Sandstone, Slate, Granite, Unglazed Brick, and Unglazed Terra Cotta, Concrete
Dirt and/or Pollutant Crusts	Water wash Water + non-ionic detergent Alkaline cleaner (ammonia or potassium hydroxide)	Water wash Water + non-ionic detergent Acidic cleaner (hydrofluoric acid)
Paint (oil, latex, acrylic coating, vinyl, epoxy, urethane-type coatings)	Alkaline paint remover (ammonia or potassium hydroxide or trisodium phosphate) Organic solvent paint remover (methylene chloride)	Alkaline paint remover (ammonia or potassium hydroxide or trisodium phosphate) Organic solvent paint remover (methylene chloride)
Whitewash and Cementitious Paints	Acetic acid <i>or</i> very weak solution of hydrochloric acid	Acetic acid Hydrochloric acid
Stains - Iron (Rust)	<i>Poultice with:</i> Sodium citrate in water + glycerine <i>or</i> Ammonium oxalate	<i>Poultice with:</i> Oxalic acid or orthophosphoric acid + sodium salt of EDTA in water <i>or</i> Dilute hydrofluoric acid
Stains - Copper	<i>Poultice with:</i> Ammonium chloride <i>or</i> Aluminum hydroxide + ammonia	<i>Poultice with:</i> Ammonia (+ EDTA) <i>or</i> Dilute hydrofluoric acid
Stains - Industrial (smoke, soot, grease, oil, tar, asphalt, waxes)	Scouring powder with bleach Water-based household detergent Ammonia Mineral spirits Alkaline cleaner <i>Poultice with one of the following:</i> Sodium bicarbonate Acetone (baking soda) Ethyl acetate Naptha Amyl acetate Mineral spirits Toluene Methylene chloride Xylene Perchloroethylene Trichloroethylene Ethyl alcohol Dry ice/carbon dioxide (Tar, Asphalt, Gum)	Scouring powder with bleach Water-based household detergent Ammonia Mineral spirits Alkaline cleaner <i>Poultice with one of the following:</i> Sodium bicarbonate Acetone (baking soda) Ethyl acetate Naptha Amyl acetate Mineral spirits Toluene Methylene chloride Xylene Perchloroethylene Trichloroethylene Ethyl alcohol Dry ice/carbon dioxide (Tar, Asphalt, Gum)
Stains - Plant and Fungal (lichens, algae, moss, fungi)	Dilute ammonia Bleaches Hydrogen peroxide Sodium hypochlorite Chloramine-T	Dilute ammonia Bleaches Hydrogen peroxide Sodium hypochlorite Chloramine-T
Stains - Graffiti (paint, spray-paint, felt-tipped marker)	Organic solvent or alkaline paint remover Lacquer thinner or acetone Organic solvent (methylene chloride) See also Paint , above	Organic solvent paint remover Lacquer thinner or acetone Organic solvent (methylene chloride) See also Paint , above
Salt/Efflorescence	Water wash Water (poultice)	Water wash Water (poultice)
Bird Droppings	Water wash Water + detergent + chelating agent such as EDTA	Water wash Water + detergent + chelating agent such as EDTA Acidic cleaners (hydrofluoric acid)

*Cleaning techniques are listed in order starting with the "gentlest means possible."

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